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editor's letter

We live in a time crippled by short-termism and dangerously narrow priorities. We must rise above this.

It's a time when political rhetoric and even policy itself dances to the distorted beat of the 24 hour news cycle, where much state decision-making on spending is hamstrung by the inability to look beyond annual budgetary cycles, where governments are addicted to policies that offer short-term gains that may boost their prospects come the next election, ignoring the long-term costs that a society exponentially losing wealth can ill afford to pay.

And then there are the costs that don't even enter into the equation in this here-and-now obsessed world, such as the cost to society of inaction on climate change, or the costs of biodiversity loss. So the Australian government can (successfully) pressure the UN to remove references to the rapidly depleting Great Barrier Reef from a UNESCO report on the impact of climate change on world heritage sites, due to the damage these revelations might do to Australia's tourism industry. The audacity is almost admirable. Or the British government can scrap a zero carbon homes target that many of the industry's leading minds have spent the best part of a decade preparing for, citing the spurious defense that cutting such proverbial red tape will help to get Britain building again, without feeling the need to provide any evidence to support such a claim. Or the Irish government can appoint a talented and well-meaning housing minister to tackle the very real, immediate housing emergency facing the country right now, and through sheer desperation consider riding roughshod over local authority powers, in the process eroding at the fabric of local democracy, while risking the creation of a substandard housing stock that may prove a millstone around the neck of generations of taxpayers, homeowners and tenants.

Perhaps the narrowest and most damaging focus of all, when it comes to politics, is personal ambition, and the Brexit referendum campaign presented a particularly stark example. The consensus among the commentariat is that Leave campaign leader Boris Johnson had no intention of winning, but that his burning ambition to become prime minister would be well served by fronting a glorious defeat. His face the morning after the referendum result spoke volumes.

The uncertainty introduced by the Brexit result also risks creating a policy vacuum, which further erodes the ability of the political classes to make progressive long term decisions. Mercifully, if we consider the silo of the sustainable building sector, most of the excellent work that's happened so far has emerged from clients, professionals and tradespeople engaging voluntarily, and that brings with it a certain resilience. But that's missing the point. It's all well and good if a niche within the industry is strong enough to continue to grow in spite of Brexit. Global temperature records continue to be shattered month after month. Decisive action is needed, and urgently.

So there is a moral imperative that the Westminster government continues to implement progressive EU policy to tackle climate change, such as the recast Energy Performance of Buildings Directive and the fast-approaching nearly zero energy building (NZEB) deadlines. But it's a political imperative too. It may even be that acceptance into the European Economic Area hinges on these kinds of actions. And any Europhile constituent countries with devolved powers and a desire to stay in or rejoin the EU as soon as possible – I'm looking at you Scotland and Northern Ireland, and Wales too, if you're having any morning after regrets – will find the transition much smoother if they start preparing, by transposing EU law. Time is fast running out on meeting the NZEB deadline, so where better to start?

Regards,
The editor

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Cover: Wain Morehead Architects, West Cork passive house
Photo: Gabrielle Morehead

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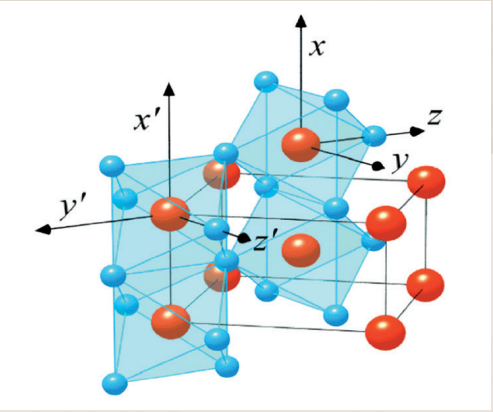

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contents

News

Energy & enviro groups lobby government to keep EU targets

Thirty leading environmental and energy groups have written to the new secretary of state for business, energy and industrial strategy Greg Clark urging the government to maintain its commitment to crucial EU targets on energy post Brexit — including the demand that all new buildings be 'nearly zero energy' (NZEB) from 2021.

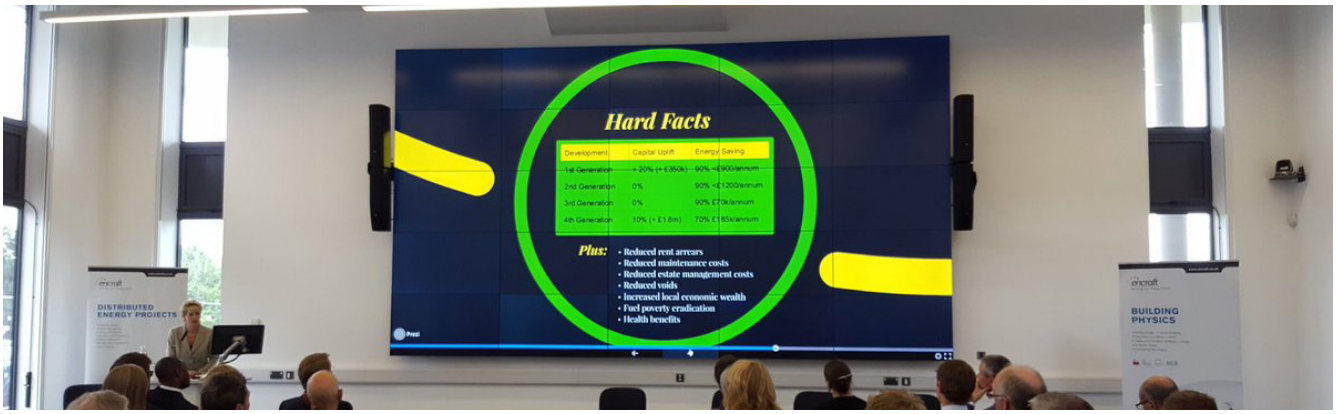
The letter, which is signed by groups such as the Association for the Conservation of Energy, the Energy Saving Trust and Friends of the Earth — as well as leading industry groups in the sustainable building and renewable energy sectors — argues that EU laws have helped to give business, investors and consumers the confidence to start moving towards a low carbon future.

It reads: "Following the referendum, it is now critical that Government restores this already-eroded confidence by giving an assurance that, until the terms of leaving the EU are in place, all relevant EU directives and targets are still in place and the UK Government is legally obliged to continue to meet them."

In particular it also calls on the government to commit to hitting the 2020 targets under the Renewable Energy Directive, which states that 15% of all energy used for electricity, transport and heating should come from renewable sources.

"These targets make a key contribution towards implementing the UK's world-leading Climate Change Act 2008," the letter adds.

Passive house is affordable for large scale housing — Encraft



Leading passive house consultancy Encraft has advised that the standard is affordable for large scale housing projects — and cheaper over the whole life cycle of a development — once there is some investment in learning and education up front.

"Passive house is becoming increasingly popular for social housing as the first choice for new build energy standards," said Dr Sarah Price, senior consultant with Encraft. "Building to passive house gives the quality, comfort and guaranteed reduced fuel bills that are all sought after attributes, especially when around one sixth of your clients are in fuel poverty.

"The first question asked before embarking on such a project, is often 'but is it affordable?" she says. "The answer to this question varies of course, but as many developers and social landlords have been demonstrating, it can increasingly be a resounding yes."

Price said that Exeter City Council are a shining example of this. "They completed their first passive house projects in 2011 totalling 21 flats and costing 20% more than they would have expected to pay for Part L compliant buildings. The lessons learnt were quickly turned around to produce 20 terraced passive house dwellings with 0% uplift in costs that were finished in 2015."

Exeter City Council now employ their own passive house consultants and have set up the EXEseed Framework (Exeter sustainable energy efficient developments framework) to provide a platform for all public sector bodies to connect with the right contractor.

"They expect contractors to deliver passive house on all new developments at zero additional cost, and have the evidence from their own projects to support this requirement. Another example of this is the £300m Norwich Fabric First Framework launched by Norwich City Council, which is open to all local authorities and housing associations to assist the development of a number of passive house and low energy projects.

"As Exeter explained at Encraft's recent annual conference in Birmingham, the key is setting sensible expectations and being willing to invest a little in learning by doing at the start. The benefits of affordable passive house for all future developments completely outweigh the short-term cost," Price said.

Whole life costs also remain an essential part of the business case for passive social housing, she added. "Exeter City Council also found that for their early projects any uplift in capital costs was mitigated by life cycle cost benefits."

Encraft has undertaken some research on the life cycle costs of passive house buildings, and has found that they can typically cost between 2 and 5% less over their lifetime than Part L compliant houses.

Visit www.encraft.co.uk/viewpoints for more information.

(Above) Exeter City Council's housing development manager Emma Osmundsen speaking at the Encraft annual conference in Birmingham in July

News

Tigh na Croit and Lansdowne Drive win at UK Passivhaus Awards

The big winners at this year's UK Passivhaus Awards were Tigh na Croit by HLM Architects, which won in the Rural category, and Lansdowne Drive by Tectonics Architects, winner in the Urban Category.

Tigh na Croit is a modern new-build passive house inspired by the form of traditional farmsteads, located in the hamlet of Gorstan in the Scottish Highlands. Lansdowne Drive is a contemporary new-build passive house on an infill site in a conservation area of East London.

The winners were announced at a ceremony held in London on 7 July, attended by approximately 80 delegates. Each finalist presented their schemes to attendees and worked with Regen Media's Ben Adam-Smith to produce a two minute video to show the project in context, with perspectives from prominent team members ranging from occupant to contractor to designer. The winners were decided by Passivhaus Trust members and award ceremony delegates, while the Rural and Urban categories were sponsored by Cygnum Timber Frame and Ecology Building Society respectively.

The winning schemes beat some very strong competition provided by five other finalists including RDA Architects, Anne Thorne Architects, Green Building Store, Gresford Architects and Parsons & Whittley. All the finalists are featured in the projects gallery at www.passivhaustrust.org.uk.

(Right) HLM Architects' Tigh na Croit, winner in the Rural category at the UK Passivhaus Awards

Frankfurt to build world's first passive hospital

Photo: Klinikum Frankfurt Höchst

Work is underway on the first hospital in the world to be built to the passive house standard, in the Höchst district of Frankfurt. The previous clinic on the site will be replaced by a new passive building with 666 beds and ten operating theatres planned over six floors. The Passive House Institute provided comprehensive support throughout the planning phase and will continue to do so during the building's construction.

In a statement, the institute said that the energy demands of hospital buildings are significantly higher than other building types due to their 24-hour operation. "The basic intention of the passive house concept, to significantly reduce the energy demand while providing improved comfort, is particularly worthwhile in the case of a hospital building. But special requirements must also be met," said Oliver Kah of the Passive House Institute.

For example, special hygiene requirements will apply to operating theatres and other sensitive areas, while room temperatures will be kept at 23C. A study by Kah and his colleagues demonstrated that medical equipment will have a major influence on the building's energy demand, and therefore must be taken into account alongside heating, cooling, hot water and lighting.

"If the building facilities are not considered, then planners will have neglected about half of the total energy demand of the clinic. Efficient devices cut down on energy and reduce the cooling demand at the same time," Kah said.

The institute has also issued a call for papers ahead of the 21st International Passive House Conference, which will take place next year at Austria's Messe Wien Congress Centre on 28 and 29 April. The theme for the conference will be 'passive house for all'.

Vienna is now increasingly turning to passive house construction — 2013 saw the opening of the 20-storey RHW.2 office tower, at the time the world's tallest passive house building. The city is also home to Eurogate, a residential passive house estate consisting of 800 apartments.

New PHPP version enables stepped retrofit
Meanwhile the institute has released a new version of PHPP, 9.6a, which includes a new Enerphit retrofit plan feature that allows designers to co-ordinate step-by-step Enerphit retrofit projects, and to apply for 'pre-certification' of such buildings.

The institute has also issued a call for projects to participate in the International Passive House Days event, which takes place from 11 to 13 November this year, and allows members of the public to visit passive house buildings around the world. For more information see www.passivehouse-international.org.

(Above left) Groundbreaking ceremony for the world's first passive house hospital. The ceremony was attended by the minister for social affairs in Hesse, Stefan Grüttner (second from right), as well as Frankfurt's head of department for social affairs, Rosemarie Heilig (third from right)

News

Green Building Store launches MVHR installer scheme

Green Building Store has announced the launch of a new approved installer scheme for its mechanical ventilation with heat recovery (MVHR) systems.

To avoid noise, inefficiency and indoor air quality problems, it is important to get the design, installation and commissioning of MVHR systems right. Green Building Store offers MVHR design, supply and commissioning. For installation, Green Building Store has now developed a list of tried and tested installers to ensure that its MVHR systems are installed correctly to achieve optimum performance.

Nell Griffiths, manager of Green Building Store's MVHR design service commented: "MVHR heat recovery ventilation plays a vital role in delivering passive house and low energy buildings. Too often MVHR systems get a bad press due to either poor installation, poor design or substitutions made further down the design process as a result of value engineering. We are confident that our MVHR systems and design, combined with installation by our excellent approved installers, will result in robust, quiet and efficient heat recovery ventilation systems."

Currently there are four companies listed on Green Building Store's Approved MVHR installers list covering a wide geographical area. Green Building Store operates a quality control check on any approved installers and has been able to check their installation quality, by commissioning the Green Building Store MVHR systems for a minimum of two installations.

For more information see www.greenbuildingstore.co.uk.

(Right) Green Building Store's new approved installer scheme has been set up to expand the reach of Green Building Store's exacting standards, such as with this Paul Novus MVHR system installation

Detail out flat roof condensation — Partel

Low energy building and airtightness specialists Partel have warned of the importance of ensuring any flat roof construction is properly designed to prevent interstitial condensation and the accumulation of moisture. Speaking to Passive House Plus, the company's Hugh Whiriskey emphasised that with more and more designers now specifying vapour control membranes in flat roof constructions, it is crucial each roof structure is correctly designed to prevent any moisture issues from arising.

"It's a question we get asked quite often – is there a rule that I can apply in general terms to all flat roofs? Unfortunately there isn't due to the mix of factors that affect moisture," Whiriskey writes in a recent blog post at his website, www.partel.ie.

He mentions three variables that can affect moisture in flat roof construction: the orientation of the roof (north facing roofs have lower solar gain and therefore dry more slowly), the colour of the outer roof membrane (lighter colours reflect more sunlight, and thus transfer less heat inside for drying) and the location of the insulation (whether it's above or below the structural elements, or a mixture of both).

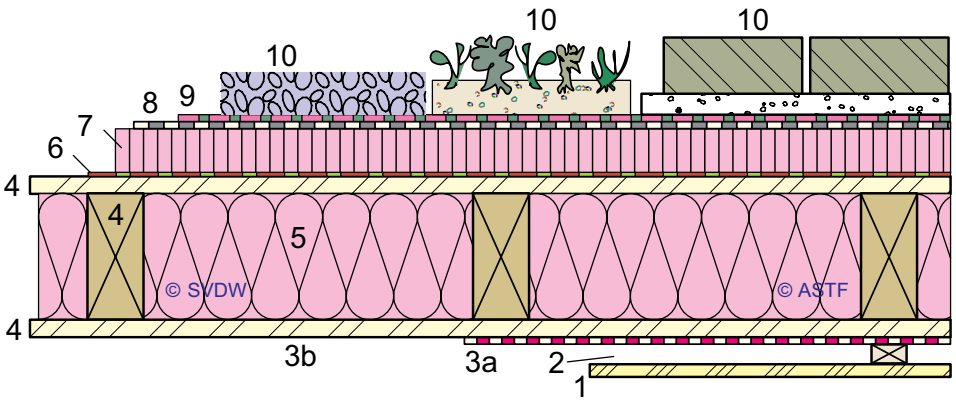
The blog post details four 'safe' flat roof construction configurations: an unventilated construction with insulation on top of the supporting structure, a ventilated construction, an unventilated construction where the insulation is within and on top of the existing structure, and an unventilated construction where the insulation is only within the supporting structure.

He points out that non ventilated structures have a lower tolerance for error, and that for the latter two roof build-ups, vapour control layers should allow for back-drying and have an Sd value of less than 10, but ideally have a variable Sd too. He writes that the more primitive Glaser method of condensation analysis will fail to calculate condensation in these build-ups accurately, and therefore he recommends a site specific Wufi analysis. "Quality of application and blower door testing is critical towards achieving results," he adds.

He also told Passive House Plus: "Current thought suggests that insulation either above or below the roof deck is safe when in reality it is more complex. A fully insulated ceiling joist with a lightly coloured closed roof membrane may actually cause problems when assessed over 20 years, and when simulated in Wufi. We are therefore now recommending insulation over roof decks and suggest a flat roof specific 1/3 to 2/3 rule, where the insulation over the timber deck be at least 1/3 that of the total insulation."

Partel supplies the Ampack system of airtight vapour control membranes, wind-tight membranes and associated tapes, which comes with a 10 year guarantee. To read the full blog post visit www.partel.ie.

(Below) A section view of an unventilated construction, with insulation within and on top of the supporting structure



News

Cygnum shortlisted for four timber awards

Leading timber frame manufacturer Cygnum has been shortlisted for four prizes at this year's Structural Timber Awards. The awards "showcase innovation, celebrate best practice and recognise expertise in timber technology and the ways it contributes to an attractive, energy efficient and sustainable built environment".

Cygnum Timber Frame, which recently became a patron member of the Passive House Association of Ireland and is regarded as one of the UK and Ireland's leading timber framers, has been nominated for two of its passive buildings. The Enterprise Centre at the University of Anglia has been shortlisted for both the Low Energy Project and the Project of the Year awards. Dubbed by some as one of the greenest buildings in the world, it features a timber frame of locally-grown pine wood with thatch cladding externally, and meets the passive house standard too. It was previously featured in Issue 12 of Passive House Plus.

Meanwhile, Cygnum and leading passive house architecture firm Architype have been jointly nominated in the Education category for the Burry Port Community School in South Wales. The project features two buildings — one built to the passive house standard using conventional timber frame, and another ultra low energy building constructed using brettstapel, a system of timber frame construction that makes use of low grade timber and avoids the use of nails or glues. The project is profiled in detail in this issue of Passive House Plus.

Cygnum and Architype have also been shortlisted in the Pioneer category for their string of successful passive house projects, including the projects above and a suite of other passive schools. Cygnum's director of UK sales Stuart Scott told Passive House Plus that during the economic downturn, the company invested a lot of time educating itself on the passive house standard, becoming one of the first companies in the UK and Ireland to develop a build system certified by the Passive House Institute. He said being nominated for the awards is, "a culmination of what we've been doing over the last two or three years. We're delighted to be shortlisted across four different categories as it is recognition for all the effort we have been putting in over the last few years."

The awards take place on 19 October at the National Conference Centre in Birmingham. See www.structuraltimberawards.co.uk for more details.

(Below) A construction shot of the UEA Enterprise Centre reveals Cygnum's precision-engineered approach.

Passive Sills awarded passive house component cert

Cork-based manufacturer Poly Passive Mouldings Ltd has been recently been awarded a passive house certificate for its Passive Sills range of thermal bridge free window sills.

The company joins a growing contingent of Irish manufacturers with passive house certificates now, including Cygnum, Pro Air, SmartPly and Munster Joinery.

Passive Sills include thermal bridge-free sills and over-sills manufactured from polystyrene, with granite or sandstone-like finishes designed to look like a traditional window sill. The company also manufactures thermal bridge-free architectural mouldings.

"We're a growth story, we started from me making this in my garage, and now we employ five people," said the company's founder Patrick Beausang.

The company was originally founded by Enterprise Ireland's New Frontiers entrepreneur development programme. Beausang said it has plans to double its production capacity and to employ 10 more people within the next 12 months.

"Our main market so far is in Ireland, Northern Ireland and Great Britain, but since passive house certification we've had our first enquiries coming from the United States," he added.

"It isn't just the passive house sector, we're finding more traditional builders starting to use our product because of its light weight and ease of use. It eliminates their manual handling risk, and of course eliminates thermal bridging at the same time too."

(Right from top) Pictured are (l-r) Poly Passive Mouldings' Aileen Donovan, Patrick Beausang, Robert Creamer, Shane McPadden and Paul Lougheed; a house featuring the company's passive sills, quoins and cornicing

News

Greentherm launches new Icynene spray foam insulations

Greentherm Solutions Ltd, the UK distributor for Icynene spray foam insulations, has announced the launch of a range of new Icynene products to the Irish and UK markets. Following on from the "outstanding success" of their 100% open cell, 100% water blown Icynene Classic, the company has now launched Icynene Classic Plus and Icynene Classic Max with thermal conductivities of 0.035 and 0.030. The company said that as with all Icynene open cell products, the latest additions are 100% open cell, 100% water blown with a global warming potential of 1.

Icynene haves also launched their closed cell range, Icynene Ultraseal Select, in three versions: spray, pour fill for cavities, and exterior for external use. These three products boast a thermal conductivity of 0.021.

Following on from the recent product launches, Icynene Ultraseal Select was successfully used to insulate the exterior of two large storage tanks at Foynes Port, Limerick. Irish distributor GMS said this product was applied to a depth of 50mm and will provide the required insulation value in addition to standing up to the rigours of the Irish climate.

For more information see www.icynene.co.uk.

(Left) Icynene's Classic Plus insulation, available throughout the UK via Greentherm Solutions

Ancon extends its range of insulated balcony connectors

Ancon has extended its STC steel-to-concrete balcony connector range with two new high performance products and a standard series of connectors manufactured from stainless steel.

Ancon STC connectors anchor an external steel balcony to an internal concrete floor slab while minimising heat loss through thermal bridging at the interface.

Two sizes have been added to the STC balcony connector range to provide a higher resistance to both moment and shear forces. Typical applications for these high performance products include large cantilever balconies and situations where column layout or rebar congestion limits the number of connectors that can be installed.

STC balcony connection brackets are manufactured in galvanised steel as standard but are now also available in stainless steel, referenced SSTC; ideal for applications where maximum thermal efficiency and corrosion resistance is required.

Comprising a two-part assembly, the STC and SSTC systems allow phased installation. One component is cast in to the slab edge with the second component installed only when required, avoiding damage by other trades as construction progresses.

Manufactured to order, the depth of the fabricated steel bracket component is variable, allowing brackets to be designed to avoid conflict with cladding to simplify installation. Serrated slots in Ancon's CE-marked steel brackets provide quick and easy adjustability on site, without stop butts or levelling shims.

Featuring an integral high-tech thermal pad, these Ancon connectors are proven through thermal modelling to help prevent condensation and mould growth in buildings.

Meanwhile Anconc's Teplo-BF low thermal conductivity wall tie has been shortlisted in the 'Best Innovation in Insulation' category of the 2016 Build It Awards.

The latest addition to the Teplo range, Teplo-BF, features the same ultra-low conductivity basalt fibre body as the original bar-shaped TeploTie, with specially moulded safety ends which make the new tie easier and safer to use and significantly enhanced mortar bond.

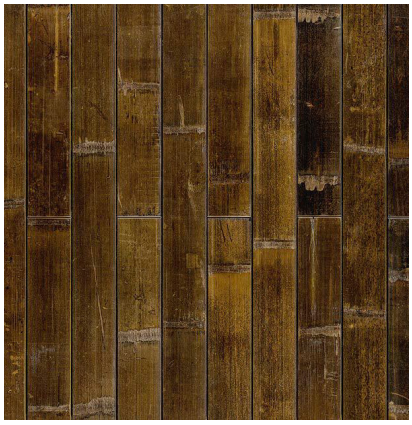
As well as providing a thermal conductivity of just 0.7 W/mK, meaning it is disregarded as a thermal bridge in U-value calculations, Teplo-BF offers an 80% increase in bond strength over the original TeploTie, making it particularly suitable for use with lime and other slow-drying mortars.

(Above) Ancon's STC low thermal bridging steel to concrete balcony connector

News

Bambeau ecological bamboo products come to Ireland


Photo: Gabrielle Morehead



The Bambeau range of ecological and sustainable bamboo flooring, panelling and veneer solutions is now available in Ireland. The company offers a wide range of attractive, ecologically friendly and sustainably produced materials.

Bamboo is technically a "giant grass" that grows and regenerates quickly once harvested, making it a particularly sustainable material. It matures at five years to form a material that is classified as wood, being composed of mostly cellulose and lignin.

The Bambeau company has been manufacturing its products to German specifications in China, where the raw material thrives, since 1994. The company's range is produced from the species Phyllostachys Pubescens, which grows on average 30cm a day and produces several times the quantity of biomass compared to traditional hardwoods and softwoods.

Bamboo is continuously harvested at 5 years of age from fast-growing plantations so there is no need for clear felling or replanting. Every year 20% of bamboo culms can be harvested. Because the plant grows so quickly, it also captures a massive amount of carbon dioxide from the atmosphere during its life cycle.

Bambeau's FSC certified range features a huge variety of products and finishes from 50mm thick, 3,100mm x 700mm boards to 0.8mm veneers. The company stated that its boards and composite materials are made from 100% bamboo, whereas in the decking it is combined with ecologically friendly resins to give lifetime maintenance-free wear. The company claim Bambeau products are cost effective compared with quality hardwood materials and also offer a hard durable finish that is equal to or stronger than oak.

As a material, bamboo offers high resistance to tension, pressure and bending as well as extreme hardness.

For more information on Bambeau products – including detailed technical information, such as thermal conductivity/resistance figures, see www.bambeau.com, while for sales enquiries in Ireland contact info@bambeau.ie.

(Left) Bambeau products were used throughout the Wain Morehead Architects passive house in West Cork featured in this issue of Passive House Plus – including flooring and furniture; the diverse Bambeau product range includes engineered products along with the likes of Auténtico, a naturally grown, strongly silicified and rock-hard unrefined bamboo culm wall

Zehnder's ComfoAir Q MVHR gets passive house certification

Zehnder Group UK has announced that its new ComfoAir Q range of MVHR units, which it called "the most efficient heat recovery system on the market", has been awarded passive house certification. This new generation of heat recovery units offers "outstanding energy and noise performance as well as smart technology that helps improve the installation process and accuracy on-site."

"The range provides up to 96% heat recovery efficiency, making it the most energy-efficient unit on the market and providing the greatest energy savings to homeowners and energy bills," a statement by the company said. "Zehnder ComfoAir Q units are almost silent during operation and are currently the quietest units on the market", boasting noise levels of just 42dB(A).

Zehnder added that the units are simple to install and easy to commission. A simple, integrated commissioning wizard and app assists with setting up the system exactly as required. The commissioning process concludes with an automatic system test and confirmation, allowing the new unit to be put into operation easily, quickly and safely.

The ComfoAir Q comes in three sizes: 350, 450 and 600 m^3/h. The unit's performance can be monitored easily via remote access on the Zehnder web portal.

Working across every new build sector, from social housing to luxury high-end developments, Zehnder has built up a reputation as both a leading supplier and authority on heat recovery systems, and is now regarded as a leader in the passive house market.

(Left) Zehnder's Passive House Institute certified ComfoAir Q MVHR systems boast efficiency of up to 96%

News

Idealcombi launches next generation casement windows

Idealcombi has launched its next generation of casement windows and doors, Frame IC and Nation IC. This new range now includes the use of PUR (polyurethane) insulation as a thermal break, chosen for its insulating value, durability and easy maintenance.

Frame IC and Nation IC are designed to offer a traditional casement style window but with modern levels of performance. By incorporating PUR, Idealcombi has brought the U-value of a traditional triple-glazed casement window down to as low as 0.77, the company said.

Idealcombi first used PUR in the Futura+ product series back in 2010 and the company reported that it was an immediate success in the construction industry. Following on from this success Idealcombi has now evolved the traditional casement window to also benefit from PUR.

Frame IC and National IC were launched last year in Denmark and are now ready for the British markets. They can be used for all build types including new build houses, passive houses, extensions, conversions, large scale residential and commercial building projects.

The units are available in both double and triple-glazed units, and feature FSC-certified heartwood, low-e glazing, and a powder coated aluminium finish.

Idealcombi Frame IC and Nation IC are available to order now for the UK market with Secured-by-Design tests and certifications currently being carried out and expected to be complete in the near future.

(Above) A section view of Idealcombi's Frame IC (left) and Nation IC (right) low energy casement window and doors.

Recoup wastewater heat recovery system at Lincoln eco-development

Last month saw Recoup's market-leading waste water heat recovery system for showers (WWHRS), the Recoup Pipe+ HE, receive a Highly Commended accolade at the Housebuilder Product Awards 2016.

The Pipe+ HE, which is used by housebuilders across the UK as a cost-effective solution to aid Part L compliance, can recover as much as 67% of the heat energy that flows down the drain with each shower. It has no moving or mechanical parts, requires no planned maintenance, and needs no end-user interaction. It is also suitable for larger commercial and public buildings.

The system has recently been installed at 'The Edge' in Lincoln, a unique residential development of multi award-winning eco-housing, designed and built by Gusto Homes. The environmental performance of each property is achieved firstly by an exceptionally high thermal mass structure which is super insulated, triple-glazed and virtually airtight.

Energy consumption is further reduced by the addition of solar PV panels, mechanical ventilation with heat recovery, low energy appliances and lighting, and waste water heat recovery for showers via the Recoup Pipe+ HE.

With the addition of WWHRS, it is estimated that the combined energy requirements for these spacious three and and four-bedroom Gusto eco homes costs as little as £1 per day.

The result is a shower system that can return over 60% of the heat energy that would normally just flow down the drain. This in turn extends the capacity of the hot water cylinder, and ensures that grid-derived energy requirements are kept to a minimum.

Recoup Pipe+ HE is a "fit and forget" technology that effectively extracts waste heat energy from used shower water in order to pre-heat the incoming cold water feed. And in modern households, where showering can consume up to 90% of generated hot water, the savings can be significant.

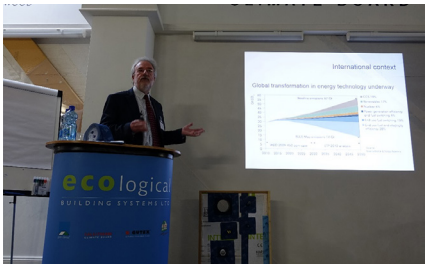
In passive houses, hot water generation is invariably the largest energy drain because space heating demand is so low, but installing a WWHRS system offers passive house designers the opportunity to drastically cut hot water demand too, according to Recoup.

For more information see www.recoupenergysolutions.co.uk.

(Above left) Pictured at the Housebuilder Product Awards are (l-r) Housebuilder publisher Ben Roskrow, Recoup's Ian Steward & Kieron Dudley, with awards host Reverend Richard Coles

News

Energy efficiency described as "first fuel" at Ecological masterclass



Energy efficiency is the "first fuel", meaning fabric-first approaches to reducing energy use in the building stock are essential, a leading Irish academic and sustainable architect has claimed.

Speaking at an Ecological Building Systems masterclass in airtightness and wood-fibre, Professor J Owen Lewis, emeritus professor of architectural science at UCD, chair of the Irish Green Building Council and former CEO of the Sustainable Energy Authority of Ireland noted that the International Energy Agency now categorise energy efficiency as the "first fuel". The basis for this claim, Prof Lewis explained in a thought-provoking keynote address, is that energy delivered through efficiency is now greater than that of oil, gas and coal combined, thus further reinforcing the need to ensure buildings are designed on a fabric-first basis using materials with a minimal environmental impact.

Ecological Building Systems held the event in conjunction with their German partners Pro Clima and Gutex on 10 and 12 May, providing a unique opportunity for architects, engineers and building professionals to learn about the latest developments in delivering high performance, healthy low energy building. The event was attended by building professionals from all over Ireland and the UK.

Michael Foerster, lead technical engineer with Pro Clima for over a decade, outlined key steps to ensure that a durable airtight and wind-tight specification is attained for the lifetime of a building. Michael also provided an overview of key steps to minimise the risk of condensation in both flat and pitched roofs.

Meanwhile Ulrich Wilms, wood engineer from Gutex, delivered a series of wood-fibre insulation seminars. Ulrich outlined the unique technical benefits of applying wood-fibre to both new builds and retrofits. Niall Crosson, senior engineer with Ecological Building Systems, also delivered a series of technical airtightness, vapour control and thermal insulation presentations highlighting the latest developments in high performance construction in Ireland.

The masterclass was completed with a number of practical demonstrations by passive house tradesperson Roman Szypura of Clioma House Ltd, and experienced lime plasterer David Broderick of DB Plaster Ltd. Following the masterclass, attendees enthusiastically requested another series of seminars with a clear interest in durable retrofit solutions. Ecological plan to hold another masterclass series based on this later this year. For more information see www.ecologicalbuildingsystems.com.

(Above left) Irish Green Building Council chair Prof J Owen Lewis speaking at the Ecological Building Systems masterclass

Prevent overheating with D&M solar shades

Leading passive house design and product supplier Young Design Build has announced that it has become the Irish and UK agent for D&M solar shading, the leading German manufacturer of external shutter technology and blind solutions. Stephen Young of Young Design Build told Passive House Plus that D&M's systems are designed to prevent overheating in buildings with large expanses of glass.

Under the passive house design software, PHPP, a building can only be certified if it falls within acceptable overheating criteria, namely that internal temperatures must not rise over an average of 25C for more than 10% of the year. Many passive house designers, however, prefer to design buildings for even less overheating than this. Specifying the correct external blinds can allow architects to design passive houses with larger areas of glazing than would otherwise be acceptable.

"I see the system helping clients and architects who have large expanses of glazing which will cause overheating within the home, office or school. By adding the discreetly hidden Zipscreen external fabric blind within the building fabric it can reduce internal temperatures," Stephen Young said. "The major benefit is that when in the closed position you can still visually connect with the outdoor space." He added that the system is also retrofittable to existing buildings.

The system can also be integrated with home automation or building management systems — for example to open automatically in the morning and then close once the room reaches a desired temperature inside, helping to prevent overheating.

The D&M range of of Fehro solar shading solutions can be fitted with various roller shutters, venetian blinds or textile screens, as desired by the client.

(Right and below) D&M's solar shade range is available in the UK and Ireland via Young Design Build

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News

Goodwood lives up to name with Viessmann biomass boiler

Goodwood Estate in West Sussex, home to the world-famous annual Festival of Speed, has constructed a new energy centre and district heating network as a step towards self-sufficiently meeting its energy requirements from renewable sources. At the heart of the new centre is a high-tech Viessmann Pyrot biomass boiler which will be fuelled by wood from the 11,500-acre estate.

Goodwood House and Estate have been home to the Earl of March's family for more than 300 years. "With this," Lord March has observed, "comes great responsibility to protect, maintain and enhance the character, setting and landscape for the enjoyment of future generations without compromising their needs." Goodwood's ultimate goal is to supply the whole estate with renewable energy.

It was this commitment to sustainability which led to the creation of an entirely new, sustainable energy centre when it was time to update the heating and hot water supply to Hound Lodge, an exclusive 10-bedroom country retreat in the estate's grounds. With an abundant on-site fuel source, a wood-fuelled boiler was a logical choice and a Viessmann Pyrot was specified. The Pyrot is a fully automatic firing boiler, for wood pellets or chippings, available in a range of six models with outputs from 80 to 540 kW and with boiler efficiency greater than 90%. The Pyrot's patent-protected rotating combustion chamber optimises utilisation of the wood gases with minimum dust emissions at all power levels and its horizontal heat exchanger can be pneumatically cleaned, significantly reducing maintenance requirements.

The energy centre has been built with a hydraulic roof which slides back to allow the tipping of woodchip into a 100 cubic metre fuel store. A rotary auger transfers the woodchip into a transverse auger which delivers fuel to the boiler's moving grate. Heat is then transferred for storage to two Viessmann Vitocell 300 buffer vessels and four Viessmann Vitocell 300 domestic hot water cylinders. The 220 kW Pyrot biomass boiler is supplemented on occasions of peak demand by an LPG-fuelled 187 kW Viessmann Vitocrossal 300 boiler.

Darren McMahon, marketing director at Viessmann, commented: "Lord March and his team are internationally famous for the excellence of their sporting events and at Viessmann we're proud that our products meet the Lord's exacting standards."

(Below) A Viessmann Pyrot boiler, installed at Goodwood Estate in West Sussex

Airflow launches new MVHR system

Airflow Developments has launched the latest addition to its successful Duplexvent MVHR range. The Duplexvent Entro utilises high performance heat recovery technology to provide optimum efficiency and protection against harmful indoor air contaminants. Available in DV250, 300 and 400 models, Airflow said its latest product innovation offers a simple installation method as well as easy-to-use controls, making it an ideal option for domestic properties.

The Entro range consists of side entry supply and extract ventilation units, suitable for use in small, medium and large dwellings up to 220 square metres. Airflow said the system operates with minimal noise whilst achieving over 90% efficiency, with air capacity of up to 385m^3/hr at 100 Pa.

The Entro range has been independently tested to comply with SAP Appendix Q criteria, enabling inclusion in an architect's SAP calculations for the specification of a high performance heat recovery ventilation solution.

Each Entro unit contains a plastic heat exchanger, to transfer warmth from the outgoing waste airstream into the incoming fresh air, while ensuring that the incoming and outgoing airstreams do not mix at any point in the exchange. All Entro units are also fitted with an automatic 100% summer bypass function to isolate the heat exchanger — ensuring no warm air is passed back into the dwelling — to provide effective cooling in the summer season.

The Entro range is available with a choice of two control panels. The basic control panel is a manual switch which is available as standard. This control allows the user to adjust the speeds of the fans, as well as enable or disable the unit's heaters, in addition to automatic functions including the air flow boost and frost protection.

Customers also have the option to upgrade to a touch screen panel for added functionality including weekly programming and maintenance reminders, as well as indoor temperature display and controls via the easy-to-use, touch screen interface.

Rob Dennis, product marketing executive at Airflow Developments, said: "We are delighted to introduce the Duplexvent Entro range to the market to provide powerful, efficient, affordable ventilation for domestic properties. The performance benefits, practical approach to installation and easy to use controls mean this is an ideal ventilation solution to protect homes against harmful indoor air contaminants all year round."

For more information on Airflow Developments, visit www.airflow.com.

(Above left) Duplexvent Entro, Airflow Developments latest addition to its MVHR range

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Can year-round internal air quality be achieved without fans?

At first glance, designing out electrical fans from ventilation strategies may appear attractive, and even sustainable. Simon McGuinness offers some home truths.

One of my students recently asked the following question:

> *In terms of air quality, if you were to consider a non-electrical ventilation system full time, or just during the summer months, is there a device that can be installed, to test air flow, so that you can ensure an air flow rate of 30m³/h/person?*

Great question.

Yes, you can fit flow rate meter inside a stack ventilation system to ensure that the flow meets target. However, in summertime you will frequently get conditions of "inversion" in houses whereby the air temperature outside a NZEB house is higher than it is inside. Essentially, the super insulation works to ensure that the heat of the day is kept out.

Under those circumstances, the air buoyancy which is needed to drive stack ventilation is simply not present. The balance of air movement is, if anything, reversed (inverted). This is a real problem.

This problem was well understood by Victorian engineers and architects used to ensuring that the "draw" on a chimney was available in all seasons. For Victorian industrialists, there was an economic imperative involved: if the coal in a boiler was not able to burn brightly due to inversion conditions causing a lack of oxygen for combustion, the factory would have to shut down due to insufficient steam to run all of the machinery required.

Victorian chimneys used for ventilation (Dublin's Mountjoy prison has two famous ones either side of the entrance block) are several storeys high, certainly at least three storeys higher than the highest extract point. Chimneys for industrial boilers were significantly higher and always required dampers to reduce excess airflow in winter. The inmates of British prisons of the era attest to the additional bone-numbing chill this induced in winter.

As a rule-of-thumb, if you want a ventilation system to work by natural means only in a first floor bathroom in Ireland/UK all year around, you will need something like a five-storey high stack. Good luck with that.

But from an energy viewpoint, such a high stack will provide significantly more ventilation than is required when there is a significantly lower temperature outside than inside. Measurements of the impact on ventilation rates in Georgian houses, shows that there is nothing which will extract all of the heat out of a house as quickly as a Georgian fireplace. Unpublished research indicates that under normal winter weather in Ireland (cold and windy) a Georgian fireplace is several orders of magnitude more powerful than even designed whole-house electrical extract ventilation at full power. Yet, that same chimney may fail to provide sufficient airflow for ventilation under still air conditions in summertime.

There are hybrid ventilation systems available (integrating the likes of Aereco's VBP Plus hybrid assistance fan) which fit an extract fan to the top of a chimney or vent and constantly work out whether the fan needs to come on using what is effectively a roof-mounted weather station – either a cup anemometer or pressure or temperature sensor. When the flow rate falls below minimum level required to achieve 30m³/h/p (or any set point) the fan cuts in, creating an artificial draught. The grills in individual rooms can also be controlled by moisture and presence sensors, as is necessarily the case with the likes of Aereco. Most of these systems do not have the ability to set a maximum flow rate and tend to over-ventilate during windy weather in winter, though Aereco report that the aperture of their room vents reduce when rooms are adequately ventilated. Such systems were developed for ventilating apartment buildings in continental Europe. Vertical ventilation shafts usually penetrate fire compartment floors and will, therefore, be required to comply with building regulations requirements on fire safety.

By comparison, DCMEV or MVHR systems are robust, cheap, reliable and exceptionally energy efficient, which is why the passive house standard has adopted the latter as the only systems it considers effective. Systems combining the best aspects of demand control (only ventilating occupied rooms) and heat recovery (reclaiming heat from exhaust air flow) are becoming available and promise even greater efficiencies than the 96% currently available with whole-house MVHR.

Distributed MVHR systems are also available which essentially operate as single room MVHR systems (Lunos, for example) and are particularly suitable for retrofit situations.

Given climate change predictions for increasing summer temperatures and more frequent storms, and the warnings of seasonal overheating in NZEB construction, it is worth modelling ventilation systems for different climate data sets at the design stage. The climate of London, for example, is predicted to be close to that of Marseilles in the south of France by the end of the current century. Ensuring that there is a mechanism to automatically bypass the recovery of heat from exhaust air in MVHR systems in summertime should be considered a minimum requirement. These bypass systems are often triggered during sunny weather in spring and autumn within passive houses, even before climate change impacts are accounted for.

So-called "natural" ventilation based on hit-and-miss trickle vents in windows or walls is a joke, it simply defies the laws of physics and of human physiology: the vents don't work when they are closed and sleeping humans cannot detect when they are suffering from CO_2 poisoning. Such "natural" ventilation systems based on wall vents and/or stack effects are not supported by any empirical scientific evidence of their year-round effectiveness. Recent evidence from the UK gives cause for grave concern, particularly in combination with NZEB construction.

There is a need for research to establish if such "natural" ventilation systems in residential buildings actually kill more people than they save – see my article in issue 7 of Passive House Plus for a more in depth discussion of this point https://passivehouseplus.ie/magazine/insight/airtightness-the-sleeping-giant-of-energy-efficiency .

My personal view is that Part F of the buildings regulations (UK and Irish) is not currently fit for purpose and will become even less fit as we embrace NZEB construction and adapt to climate change, a veritable double-whammy of impacts on indoor air quality.

As if to underline this point, the directors of at least one international commercial certification body, who operate a credible independent building certification system in Ireland, state that their risk assessment process often highlights that designers and clients should consider mechanical ventilation as natural ventilation, poses a number of serious compliance issues with Part F and L. Part F minima are very far from current best practice in relation to residential ventilation specification and there is an urgent need to "raise the floor" on ventilation regulation.

Simon McGuinness is an architect, certified passive house designer and lecturer at DIT School of Architecture.

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Let's move beyond the sustainable city oxymoron

A truly sustainable built environment hinges on a multiplicity of factors, not least including the context within which a building sits. Dr Peter Rickaby argues that a focus on cities may lead us in the wrong direction.

Imagine yourself looking down on a city like London from a satellite. You would see a huge agglomeration of buildings, most of them heated, some also cooled and expelling heat, many ventilated and artificially lit throughout the day. You would also see centres and sub-centres, and a tidal flow of millions of people into those centres each morning, and out to the suburbs and beyond each evening, some on foot or by bicycle, most in trains, buses or cars. Journeys of fifty miles are common. Would you be looking at something sustainable?

Over thirty years ago, I was part of a group of university researchers investigating energy use in cities and regions. It was a small group, perhaps thirty of us in universities in Europe, the US, South America and Asia. We worked with a larger international group of land-use and transport simulation modellers, both academics and consultants. The research provided many insights, but in the 1980s governments and city authorities were uninterested, so we published our results and moved on to other careers.

In the 1990s, academics from Oxford Brookes University finally caught the UK government's attention with the idea of the 'compact city' – increasing urban densities to improve sustainability. The idea was that higher densities and car restrictions would encourage us to walk or cycle instead, and would improve the viability and attractiveness of public transport. The compact city idea was seized upon by architects and by house-builders, for whom higher densities (i.e. more homes on smaller plots) chimed like a cash register. Planning guidance was duly issued, housing densities were increased, streets were narrowed and minimum parking standards became maximum parking provision. The unintended consequences are that outside our suburban homes we now find ourselves clambering over cars parked on the pavements, and our back gardens are tiny, overlooked and too over-shaded for growing vegetables. Perhaps a few people have left their cars at home and gone to work by bus, but in our city centres we still have dangerous air pollution. The compact city idea (which is actually about compact suburbs) has failed.

Now the sustainability of cities has become a hot topic. With the world's population urbanising at an alarming rate, almost every city authority has a sustainability programme. There are many books about sustainable cities. Consultants offer 'smart' ways of making urban systems more efficient. We promote 'zero carbon' buildings, passive house, green roofs, heat networks, sustainable urban drainage, flood protection, city farms, electric cars and buses, on-demand taxis and new rapid transit to bring even more people into urban centres each day or allow them to cross a city entirely on their journeys to work. But are we looking at the correct issues? The problem is that the research in the 1980s suggested that lower densities, not higher densities, improve sustainability, so a more radical approach may be required.

Historically, cities have arisen wherever people needed to come together to trade, create markets and share their culture, and they have served us well. However, all cities are parasitic on hinterlands. The hinterland of a medieval city was an area fifty or a hundred miles across, where resources were quarried, mined and forested, food was grown and waste was disposed of. Tentacles of trade reached out over greater distances. Now, the overlapping hinterlands of twenty-first century cities embrace the whole world. Thus to suggest that we can draw boundaries around high-density cities, and somehow make them sustainable within those boundaries, is absurd: cities are inherently unsustainable. We should think instead about sustainable settlement patterns on regional and national scales.

The 'seers' of planning history such as Soria y Mata, Ebenezer Howard, Frank Lloyd Wright, Patrick Abercrombie and Melvin Webber understood these ideas. Howard's Federation of Garden Cities was an integration of town and country bound together by railways. Wright's Broadacre City was a vision of a low density urbanised, agrarian continent bound together by car travel. In London in 1938, Wright predicted that cities ("monuments to greed") are destined to wither away. Abercrombie's Greater London Plan of 1944, and the associated New Towns programme, were founded on the principle of reducing urban densities to alleviate squalid and unhealthy conditions there, and building instead in the suburbs and the hinterland, deliberately spreading the city in a controlled way.

We need multi-centred regional and national settlement patterns that integrate agriculture with urban living to provide local food production, that embrace clean industrial production, waste disposal and recycling, that provide space for locally generated renewable energy, and space for recreation. All these features need low densities. Alongside them we can use information technology to provide world-wide economic and cultural connections, to support home working and reduce expensive, time-consuming, energy-wasting commuting. So let's have a vision for our settlements, and stop talking about 'sustainable cities' – it's an oxymoron.

Dr Peter Rickaby is Director of Rickaby Thompson Associates Ltd and a Trustee of the National Energy Foundation (NEF). The views expressed here are his own, and not necessarily endorsed by the NEF.

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Our passive journey #2

In her second column documenting her family's self-build passive house project, Nessa Duggan details the process of choosing a build system and finding an architect.

As complete self-build novices aware of the steep learning curve ahead, we were eager to get stuck into our passive house project. After deciding we wanted to build to the passive house standard, our next step was to find someone to design the house and prepare the planning application. Little did we know the extent of the challenge we faced. The decision to aim for the passive standard limited options of finding local expertise for the project.

Our 0.3 acre site is outlined with beautiful mature foliage and a narrow road frontage. Previously the side garden of an adjacent home, it is in a reasonably densely populated area of Co Louth on a road lined with detached houses.

The existing outline planning permission listed several conditions for the design, and our brief was for a comfortable, functional family home of around 250 square metres. We found stories online of self-builders that had achieved the passive house standard for not much more than the cost of building to current building regulations, and we rather liked the sound of this too.

External aesthetics and architectural features were never high on our agenda. We felt a simple design was important — because that's who we are, and because it would help to control costs. We did not want elaborate external features, instead we wanted to prioritise the building fabric, energy performance and the function of the living spaces.

Our preference was for timber frame construction and, as we saw it, there were three options worth exploring. The first option was an 'off the shelf' kit house — this seemed like the path of least resistance and was certainly appealing to use. The second option we considered was purchasing a set of standard plans for a passive house. But the narrow shape and orientation of the site were not ideal for a typical longer, rectangular off-the-shelf passive house.

Considering the conditions of the outline planning permission, and the context of the site, we decided neither of the first two options were the best for us. With a garden just off due south, orientation was in our favour for balancing energy losses and gains, and maintaining privacy at the front of the house. But the width of the site meant a narrow rectangular house the size we needed wouldn't fit. We decided that option three, a bespoke design, was the best route.

We felt it was worth challenging the conflict between the passive design principles of minimising the house's footprint and external surface area, and the outline condition of a 'storey and a half style' dwelling. We didn't await a bungalow ether — it would need a bigger footprint and would mean tearing up the mature trees we loved and leave a very small garden, defeating the purpose of the move.

Our mission was to find someone singing off the same hymn sheet to develop a design and manage the planning application. Completion of PHPP calculations early in the design stage was important to us too. We met several professionals offering the service we needed for prices that varied significantly.

We quickly discovered that hiring an architect for 10% of the build cost was not compatible with building a house of sufficient size to make the project worthwhile. We were advised to build a smaller house initially, and to increase it in phases. This was not a viable option for us either though. We also struggled to find an architect aligned to our priorities of a simple design and minimal footprint — the suggestion being that to compromise on aesthetics by minimising external architectural features was completely nonsensical.

We asked around and met with several people who could provide the service we needed at a lower cost than a fully qualified architect. All advised that the planning process was more likely to be successful if we just settled on a storey and a half, or dormer style. We decided to give one of them a chance and the first concept presented was a H-shaped bungalow, with a car port enjoying the evening sun! Back to the drawing board.

We finally met an architect who seemed to genuinely buy into passive house design principles and listened to our needs. We agreed a service that included design and PHPP calculations up to the submission of planning permission, so we have signed up to a fixed price contract and started preparing a detailed design brief for our new passive home. *To be continued in the next issue.*

"We did not want elaborate external features, instead we wanted to prioritise the building fabric, energy performance and the function of the living spaces."

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Brexit & sustainable building: risks & opportunities

While the implications of the Brexit vote are still being worked out, the decision is bound to have profound implications on the UK construction industry – introducing both uncertainty and opportunity to the UK's transition to sustainable building, argues Dr Neil Cutland.

I'm writing this some two weeks after the astonishing vote by a majority of UK residents to leave the European Union. I'm also just back from a week of industry events, which included the Passivhaus Trust's annual awards ceremony and the All-Party Parliamentary Group for Renewable and Sustainability Energy (PRASEG) conference. The country's initial shock at the referendum result has subsided a bit, and I've had a chance to reflect upon the referendum result in the light of these two industry events. More about them later.

Several years ago when the possibility of Brexit (I hate that word, but one can't avoid using it these days) was first mooted, as a sustainability and energy consultant I was deeply worried at the possible implications. We've known since 2010 that the Conservative government (even while in coalition with Liberal Democrats for the first five years) was on a mission to dilute, repeal and cancel as many environmental policies as it thought it could get away with. To name but a few: the removal of local authorities' powers to set energy efficiency standards beyond Part L, the abolition of the Code for Sustainable Homes, the removal of onshore wind farm subsidies, the axing of the Green Deal, the imposition of Climate Change Levy taxes on renewable energy supplies, and many more. I nevertheless took comfort in the fact that a lot of the legislation was driven by EU directives with which the UK was obliged to comply – but hence also my concern at the thought of possibly leaving the EU.

Then came a strange twist in the plot. One of the major policies that I assumed would survive last year, because it was so clearly mandated by the Energy Performance of Buildings Directive, was the zero carbon homes 2016 standard. But no. As soon as the Liberal Democrats were out of the way, the Conservatives cancelled that policy too. They drew on an obscure clause in the directive about 'cost optimality', arguing that what we introduced as Part L in 2013 was a good-enough definition of 'nearly zero energy' within the constraints of cost optimality. So in this instance even the existence of a clear EU directive didn't stop the government revoking the national policy, even though we were (and technically still are) bound by it as members of the EU.

Rather perversely perhaps, at that point I felt oddly relieved that the government could ride roughshod over such a key EU directive! My logic went like this: there was an EU directive mandating this thing, but the government managed to abolish it anyway; therefore it probably won't make all that much difference whether we ultimately leave or remain in the Union – the government will do its stuff, either way. So at that point I stopped worrying about a possible Brexit quite so much.

Back to the two industry events that I attended last week. The first was the Passivhaus Trust awards ceremony, where some really interesting rural and urban self-build homes were up for prizes. What struck me here was that the passive house community is just quietly but enthusiastically getting on with it, voluntarily, unmoved by national or European legislation (or by the lack of it). What we definitely know is that once a client takes the trouble to understand the passive house standard and the design/build ethos, passive house sells itself. Whether one's main driver is energy conservation, lower running costs, a healthy home or climate change mitigation, passive house simply makes sense. In this respect, again, perhaps we needn't be quite so concerned at the impact of leaving the European Union.

Next to the PRASEG (the All-Party Parliamentary Group for Renewable and Sustainable Energy) annual conference. The audience included several MPs and Lords, who were rather more formal but no less enthusiastic than the passive house audience the day before. The conference focus was on decentralised energy, and once again a number of passionate and dedicated speakers painted a very upbeat picture about what is being done today and what we can do in the near future, even in the face of a currently downbeat policy landscape.

But then Lord Peter Mandelson took to the stage to deliver the keynote speech. He was clearly still angry about the referendum result, describing a very bleak future for the UK and going so far as to suggest that "the rest of the world currently regards us with a mixture of pity and incredulity". With the mood suitably dampened, Lord Mandelson did at least go on to exhort the audience to rally, to speak with one voice and to become "a bridge between politicians, the banks and industry". He also called upon the new prime minister to ensure that even from outside the European Union the UK can continue to participate in the EU Emissions Trading Scheme and to trade on the European energy markets. Overall, however, he offered very little in the way of certainty.

Once again I found myself somewhat irrationally feeling comforted by the fact that even this ex-Trade and Industry Secretary and ex-European Commissioner wasn't sure how the thing will pan out. I think my comfort comes from the realisation that it's not just me who feels confused, concerned, uncertain and fretful; even the experts do. And this in fact empowers all of us, because for once we can have the absolute confidence that each of our individual ideas and solutions are at least as valid as those of the politicians and negotiators, and may even hold the key.

Even more reason for us in the passive house community to keep pushing our agenda!

Dr Neil Cutland is the director of energy and sustainability firm Cutland Consulting Limited. He was intimately involved with the UK's zero carbon homes policy for 10 years, and has served on the board of the Passivhaus Trust. His current interest is in assisting local authorities to maintain the energy standards in their local plans, given their reduced powers under the Planning and Energy Act.

"The passive house community is just quietly but enthusiastically getting on with it, voluntarily, un-moved by national or European legislation - or by the lack of it."

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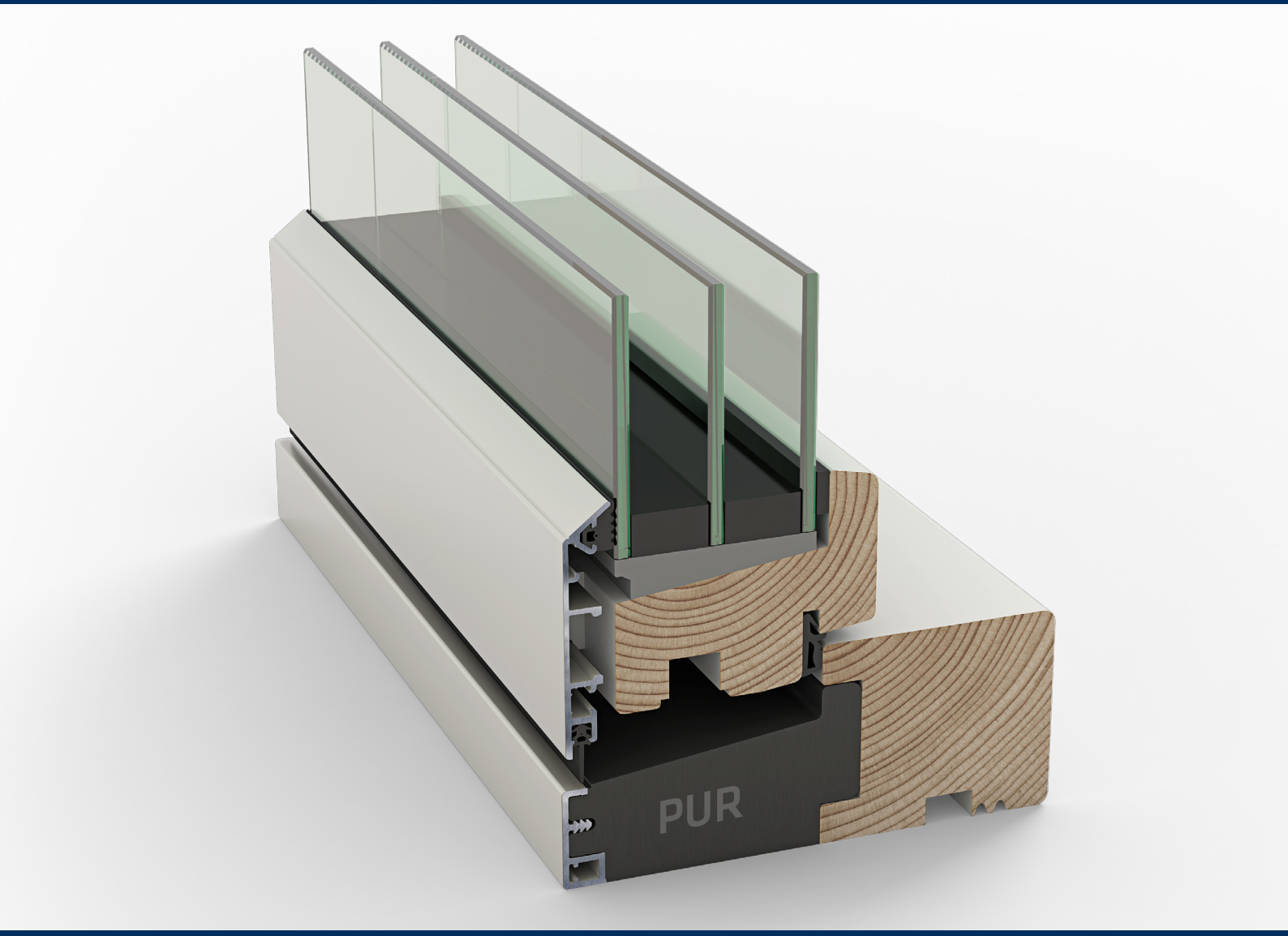

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INTERNATIONAL SELECTION

This issue's round up of the best passive house buildings from around the world features a striking timber frame home in Oregon, a public library in the north of Spain, and a tennis academy in Sweden.

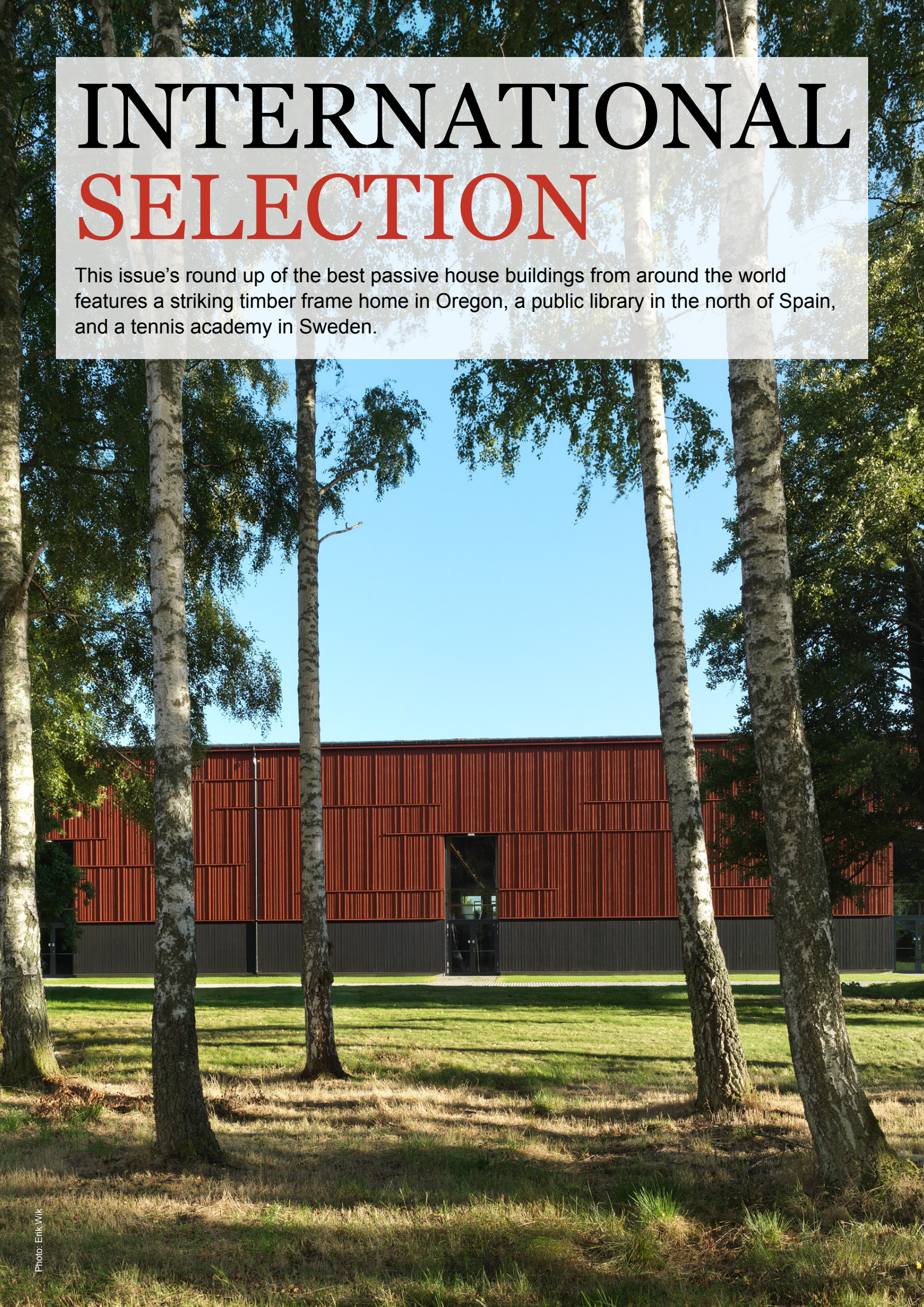

Photo: Erik Wik


Photo: Robin Fritzson


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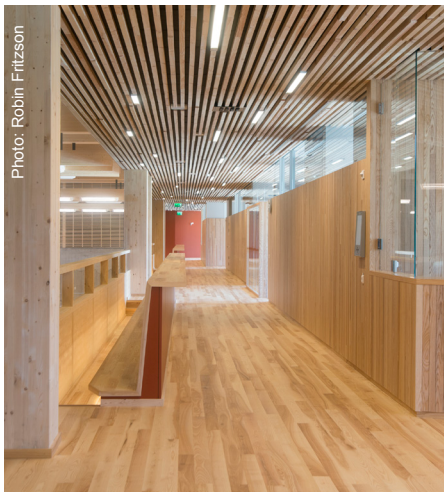


Photo: Robin Fritzson

Södra Climate Arena, Växjö, Sweden

Opened in 2012, the Södra Climate Arena in pioneering green city Växjö is the result of an international architectural competition arranged by Södra — the organisation of forestry owners in the south of Sweden — to design a low carbon timber building that would accommodate an elite tennis academy.

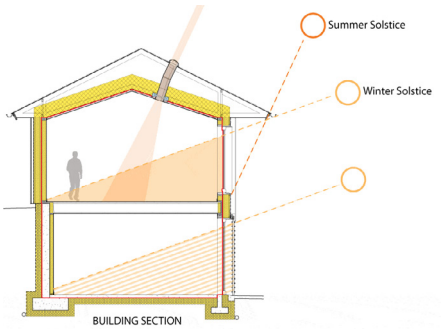
The competition received 193 entries from 23 countries, and was won by Danish architect Kent Pedersen, who had previously trained as a carpenter.

The new tennis centre sits on a grassy site that slopes downward toward Lake Växjö, right next to Södra's own headquarters. It was principally constructed from timber frame that was insulated with mineral wool, and scored a world-class airtightness test result of 0.13 air changes per hour.

The facility is now run by Ready Play Tennis, a company established by Swedish tennis legend Stefan Edberg and other ex-pros to develop the country's tennis stars of the future. The building features four tennis courts, classroom, meeting room, office, café, changing rooms and gym, and it won the Swedish Passive House Architecture Award in 2013.

More recently, monitoring results show that the building's heating consumption during the first two years was even lower than expected — and that it uses almost no energy for heating or cooling. ►

Photos: Jeff Amram



Pumpkin Ridge, North Plains, Oregon, USA

The Pumpkin Ridge Passive House in North Plains, Oregon, is no more expensive on a monthly basis than a typical custom-built home, when taking account of energy bills as well as mortgage, taxes and insurance — that's according to its builders, construction firm Hammer & Hand.

Designed by Scott Edwards Architecture, the timber frame house negotiates a wooded sloping site, with a single storey on the north façade and two storeys plus a day-lit basement to the south. Optimising passive solar heating gains was a major design goal for the architects, while generous overhangs provide shade during the summer and allow solar heat gain during the winter.

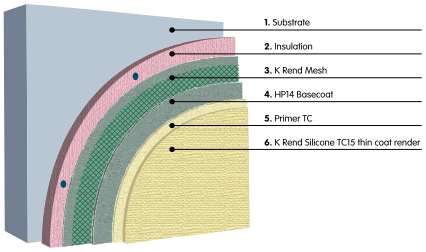
The design team kept the form of the building simple too, with few articulations. The modest surface-to-volume ratio that this affords means less heat loss, and less demand on the performance of the building envelope.

During the design phase, Hammer & Hand ran thousands of simulations to optimise design elements like building siting, shape, window placement, wall thickness, insulation levels, and other design parameters— and this process was key to the affordability of the project, according to the firm.

"Our clients knew they wanted a very energy efficient, high performance home, but they didn't think they could afford to build a passive house," says Sam Hagerman, co-owner of Hammer & Hand. "I had the pleasure of showing that when monthly energy costs are accounted for alongside the monthly cost for mortgage, taxes and insurance, owning and operating a passive house need be no more expensive than your run-of-the-mill custom home." ▶

Transforming facades with silicone technology

An external wall insulation system is a thermally insulated, protective, decorative cladding procedure involving the use of an insulating material and a render finish. The most common insulating material is polystyrene, others such as mineral wool, polyurethane foam of phenolic foam may be used. The render finish usually consists of a reinforced basecoat followed by a decorative mineral or synthetic finish.



The K Rend Silicone Thin Coat range is particularly suitable where lightweight render systems are required, such as an external wall insulation system (illustrated right).

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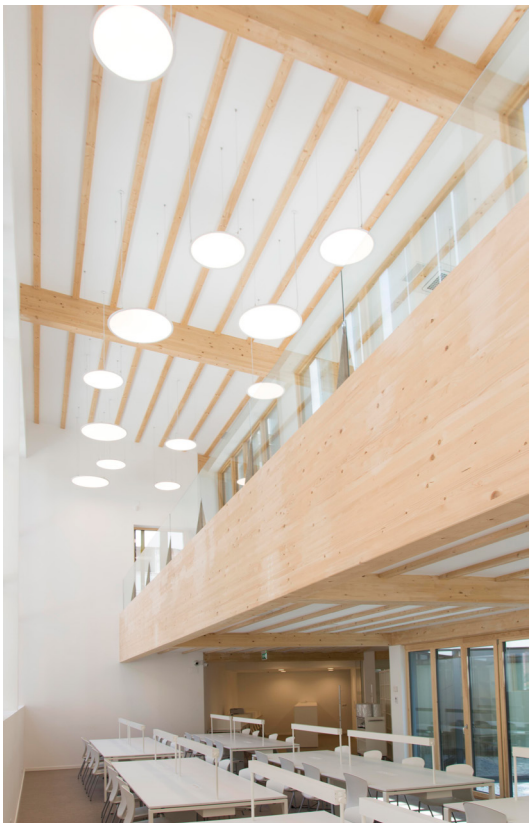

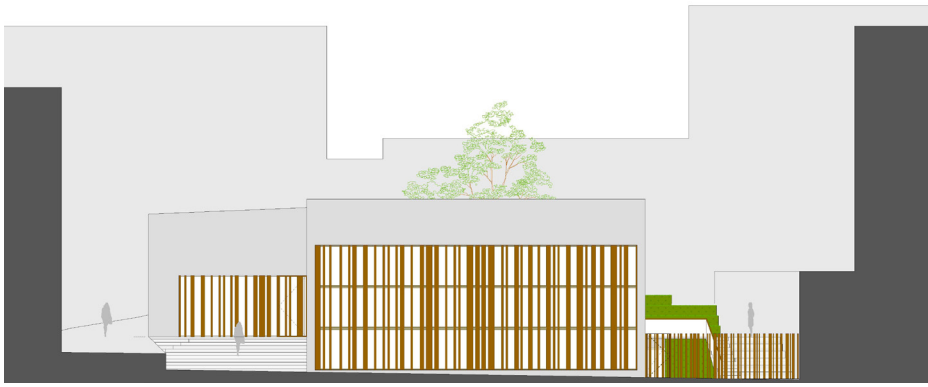

Photos: Play Arquitectura

Public library, Villamediana de Iregua, La Rioja, Spain

Villamediana de Iregua is a small town in northern Spain, with 7000 inhabitants, and under the area's most recent urban plan, all public buildings must meet the passive house standard. The first opportunity to put this policy into practice came with the design of a new library in 2013.

Opened last year, the new library's design is based on two conjoined cubes: the large one serves as the main reading space for the library, while the smaller cube provides room for circulation and services.

The building's volume was moulded to lower its height eastward too, allowing the roof of the building to become a grassy outdoor reading area with a central courtyard that illuminates the library's interior, ensuring all reading spaces have natural light. A maple tree in this courtyard also references the idea of the tree of knowledge.

Designed by Play Arquitectura, the library is also half-buried, moderating its temperatures to help keep it cool in summer and warm in winter. This also minimises its height amid surrounding buildings, creating the perception of an "urban void".

The building was constructed with lightweight brick that was insulated externally with polystyrene, with some mineral wool insulation on the inside, while airtightness is primarily provided by the plastered brickwork.

The library's south and west façades are the most heavily glazed for solar gain, with horizontal shades on the south façade, and vertical shades on the west — the latter creating a clever visual reference to rows of books on the library shelves inside. ►

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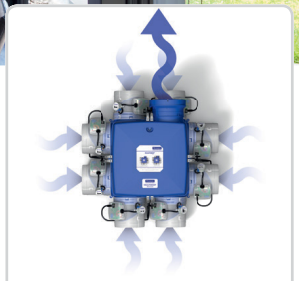

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Chiswick Eco Lodge

stitches into historic London street

For this exciting new dwelling in west London, architect Richard Dudzicki faced the challenge of designing a contemporary light-filled home while not offending the sensibilities of its Edwardian surroundings. He also had to meet the passive house standard, too.

Words: David W Smith
Photos: Chris Sowe (furnished) & Tim Soar (unfurnished)


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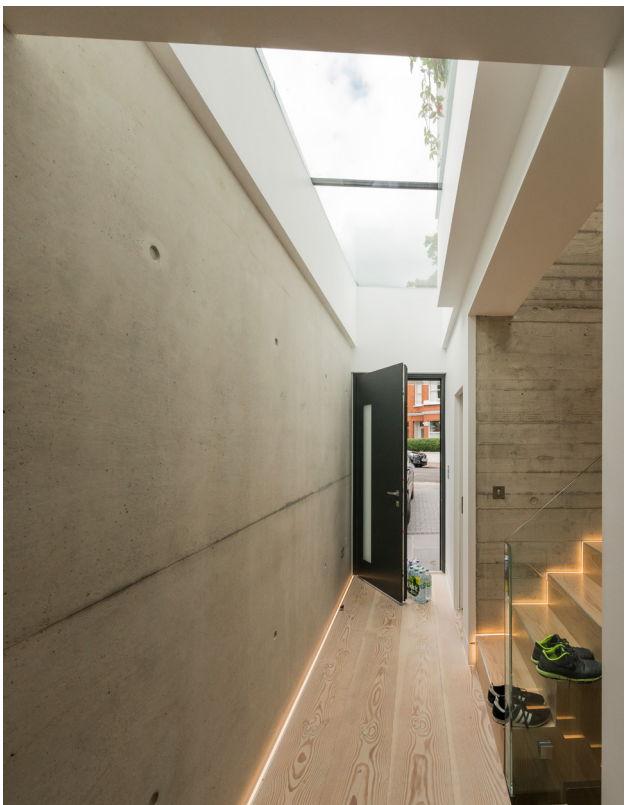

Retired music producer Oliver Smallman had no intention of building a passive house when he approached the London architect Richard Dudzicki for help designing a house. Smallman had simply seen pictures of Dudzicki's own self-designed house in London's Evening Standard, and was drawn to its modern eco-friendly aesthetic.

He set up a meeting with Dudzicki, the director and chief architect at RDA, to discuss working together to design a three-bedroom, three-storey house on a small former garage plot next to Smallman's existing home. But when Dudzicki mentioned the passive house concept, Smallman's imagination caught fire. "I'd never heard the word, but after frantically Googling for information I completely adopted the idea and now I've seen the end results, I'm thrilled."

Smallman and his wife Holly intend to move into the £450,000 'Chiswick Eco Lodge' at a later date, but for now they are renting it to the Nashville singer-songwriter Ed Pettersen and his wife. Pettersen specifically wanted to rent a passive house in London, and chose it before moving over from the US. But when he arrived, there was an unexpected bonus. The central living space possessed such extraordinary acoustic properties that Pettersen decided to install a full recording studio complete with 20 guitars. It turned out that the materials used to create the passive house worked equally well for sound quality.

"He says it's the best studio environment he's ever worked in," said Smallman. "The sound is getting assistance from the triple glazing, Dinesen wooden floors and the concrete, which keeps it nicely subdued. He sits there playing his guitars as happy as a bumble bee."

Though Smallman loves the finished product, it would not have been possible without a tough three-year battle over planning regulations. Some residents of his Edwardian street in Chiswick were aghast at the prospect of a modern house. "After we made a planning application, I was almost lynched at the hearing in the town hall," said Dudzicki. "Everyone wanted it to have an olde-worlde look even though it was on a derelict brownfield site."

RDA lost the first planning application, but didn't give up. They modified their design, making it smaller and trimming back the roof. Dudzicki sank the lower storey below street level to avoid overlooking neighbouring properties. After three years, they finally won planning permission. "But everyone was still up in arms until a few weeks ago when we asked a neighbour if we could photograph it from their rooftop. The top floor was discreetly hidden away. It has a living wall and a sedum green roof. They said it looked lovely and now no one on the street is complaining."

Planning regulations also stipulated that the concrete core had to be covered in London stock bricks to blend into the environment. Dudzicki used brick slips that are purely decorative to appease local anxieties. "We've got blue engineering brick slips below ground and above ground we've got the London stock, which looks lovely. Then the top part of the building disappears with the living walls around it. Six months after we installed it, it's growing and developing nicely," he said.

The house – a Gold Award winner at the 2015 London Design Awards and finalist in the urban category at this year's Passivhaus Awards – was completed in September 2015, but has only been lived in for a short time. Judging by the first two months of bills, the Chiswick Eco Lodge is living up to its name. The tariff was just £15 for electricity and £20 for gas for one month between April and May.

But achieving such a positive result was not always straightforward. The confined space presented different technical challenges, Dudzicki says. And there was a greater emphasis on creating a stylish interior than on his previous project. "It's my favourite passive house we've done because we designed it from the inside out like a true building should be. You can get so caught up in PHPP that you end up designing from the outside in as you worry about window sizes, thermal envelopes, walls and so on. We started like that, but it was such a challenging site overlooking neighbours that we were forced to change our approach."

At the outset, there were two major challenges. There was a tree at the front of the house and its roots had to be avoided. And the design had to guarantee enough light on the south-facing side. Dudzicki managed to solve these issues and Smallman approved the designs, which had two bedrooms in the basement, an open-plan living and kitchen area on the ground floor and a smaller top floor containing a study, or third bedroom. The intention was to build the house as a kit, using imported panels, but the site's geology scuppered this idea. Soil investigations revealed that sheet piling would not work through the riverbed shales and Dudzicki

had to opt for corkscrew piles with some underpinning of the existing house on the site.

“We looked at the project as a construction technique and decided to use concrete as the main material. We’d never done a heavyweight structure before for a passive house. They were mainly lightweight. But it made more sense economically because we didn’t need two sets of contractors and it also worked well ecologically. You can insulate the outside of the concrete like a tea cosy around a kettle. It stays warm for a long time because it’s heavier. It has a slower response time like a storage heater but once it gets to a certain temperature, it stays warm.”

The insulation process was not straightforward, however. The ‘tea cosy’ could be wrapped around the outside of the building for the two storeys above ground, but that approach did not work for the basement. “You have to step in on the ground floor so the insulating tea cosy runs from the outside to the inside of the building,” he said.

There were also unexpected technical challenges such as when Dudzicki turned up on site one day to discover there were problems with the beam-and-block system installed in the basement. Normally, the beams would go on hangars on outer walls and there would have been an airtight seal, but they were driven straight into the walls. “They had oversized the beams and put them straight into the walls, leaving T-shapes all around. The question was how do we make it airtight?” So the gaps around the beams were filled in, while the main airtightness layer was formed by plastering the walls to the outside.

Air tests showed that the building was functioning well. Before the windows went in, it had to pass a test showing less than 0.6 air changes per hour. The team taped up the window spaces with airtight sheeting and performed the test, which went fine. The next tests came after the Internorm windows were installed. “We had to be careful putting in airtight tapes. They had to be bunny-eared, meaning pinched not cut around the corners. The builders had not done it before but they managed it,” he said. Again the building passed the air pressure tests.

The focal point of the house is the central concrete staircase. All the floors are suspended from this core, rather like in a skyscraper. The plentiful use of concrete also presented aesthetic possibilities. The concrete in the staircase was adorned with wooden shuttering. “When the wooden shutters came off the internal concrete, some of it peeled off but we left it, so we had rough next to smooth, creating almost a sculptural effect,” he said. Parts of the walls in the living room on the ground floor were concrete, too, but the designers used polished metal shuttering here.

Getting enough light into the rooms was a priority for Smallman in the confined

“The central living space possessed such extraordinary acoustic properties that Pettersen – a singer-songwriter – decided to install a full recording studio.”

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urban space, and several solutions were found. In the open-plan living space, a large roof-window above the entrance hall brings in light and on the top floor, which has smaller windows to minimise the impact on neighbouring properties, there are two skylights. Even in the basement, the two bedrooms open onto private courtyards and a bridge link connects them to a private sunken courtyard garden at the back of the house. “It’s all interlinked and was complex to design, but it works well,” said Smallman. “It’s all about having both private and public spaces. There are lots of levels and different ways of walking around the space and being in it. The sunken courtyard has

(below) Due to difficulty obtaining planning permission, the lower storey was situated below street level to avoid overlooking neighbouring properties; (bottom left) wall build-up showing Intello airtightness membrane, which was used in places to ensure airtightness, followed outside by a Wetherby external insulation system; (bottom right) space heating is provided solely by the Paul Novus 300 MVHR system with phenolic insulation boards, the plant room includes a Worcester heating and domestic hot water system including 250 litre tank fed by solar vacuum tubes and condensing gas boiler, alongside a Paul Novus 300 MVHR system.

also been designed to encourage as much light as possible. We’ve painted everything white to reflect light and added a lightweight staircase that doesn’t overplay itself.”

Dudzicki worked with landscape designer James Lee to provide overshading in the summer months. “We’ve not added any solar blinds, but we’ve allowed some plants to grow deciduously to allow shading at the back of the garden,” he said.

Smallman is delighted with the results. “I have an aversion to dark houses but it’s flooded with light and looks really beautiful,” he said.

Want to know more?

The digital version of this magazine includes access to exclusive galleries of architectural drawings.

The digital magazine is available to subscribers on www.passive.ie

SELECTED PROJECT DETAILS

Client: Oliver Smallman
Architect: Richard Dudzicki Associates
Main contractor: Belgravia Construction Group
Passive house consultant: Mead Consulting
Civil & structural engineer: Michael Hadi Associates
MVHR system & airtightness products: Green Building Store
Electrical contractor: Solid Core MSP
Airtightness testing: Air Testing Ltd
External wall insulation & cladding: Wetherby
Additional wall insulation: Jewsons
Floor insulation: Dow
Windows & doors: Internorm
Roof lights: Glazing Vision
Screeds: Premier Screeding
Gas boiler: Complete Plumbing Service
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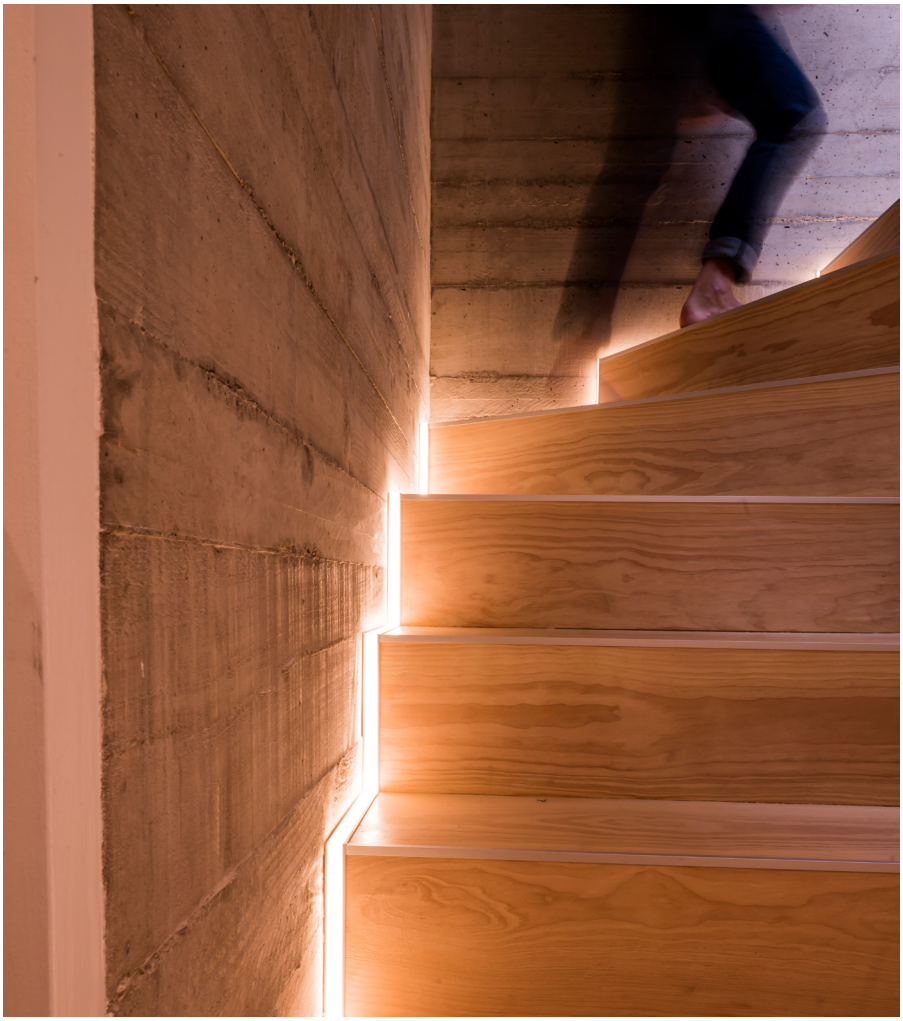


PROJECT OVERVIEW

Building type: 110 square metre detached single residential unit

Location: Hatfield Road, W4 1AE, London, UK

Completion date: September 2015

Budget: £450,000

Passive house certification: Passive house certified

Space heating demand (PHPP): 15kWh/m^2/yr

Heat load (PHPP): 9 W/m^2

Primary energy demand (PHPP): 93 kWh/m^2/yr

Environmental assessment method: Environmental Impact Rating B91

Airtightness (at 50 Pascals): 0.572 ACH

Energy performance certificate (EPC): B88

Measured energy consumption: Not available yet

Basement floor: Reinforced concrete slab (250mm) with 300mm Dow Floormate 700-A rigid insulation. U-value: 0.12 W/m^{2}K

WALLS

Basement walls: 250mm Dow Floormate 300-A rigid external insulation outside 250mm reinforced concrete retaining wall. U-value: 0.146 W/m^{2}K. Reinforced concrete wall (175mm) with 220mm Wetherby phenolic external insulation board system. U-value: 0.09 W/m^{2}K

Ground floor wall: Reinforced concrete wall (175mm) with 220mm Wetherby phenolic external insulation board system, finished outside with blue/grey engineering brick slips at lower ground flower level and London stock brick slips at ground floor level. U-value: 0.09 W/m^{2}K

First floor wall: Blockwork wall (140mm) with 220mm Wetherby phenolic external insulation board system. White render with living wall externally. U-value: 0.085 W/m^{2}K

Internal finishes comprise a mixture of timber, white paint, and smooth concrete

Roof: Pre grown modular green roof system externally, followed underneath by Rhepanol HG 1.8mm roofing membrane, Kingspan Thermataper TT47 LPC/FM PIR insulation system (170mm average, 140mm minimum thickness), vapour control layer, 65mm concrete screed, 155mm beam and block system, 40mm service void, 12.5mm plasterboard layer, 3mm smooth finish skim coat plaster. U-value: 0.145 W/m^{2}K

Windows: Internorm HF310 triple-glazed aluminium clad externally, with argon filling and overall U-value: 0.69 W/m^{2}K

Heating system: Space heating provided solely by MVHR (see below). Solar vacuum tubes from Worcester, Solar-Lux 6/12 supplying a 250 litre domestic hot water tank which is topped up by a gas condensing system boiler, which only provides hot water

Ventilation: Paul Novus 300 Passive House Institute certified MVHR system

Electricity: LED lighting throughout

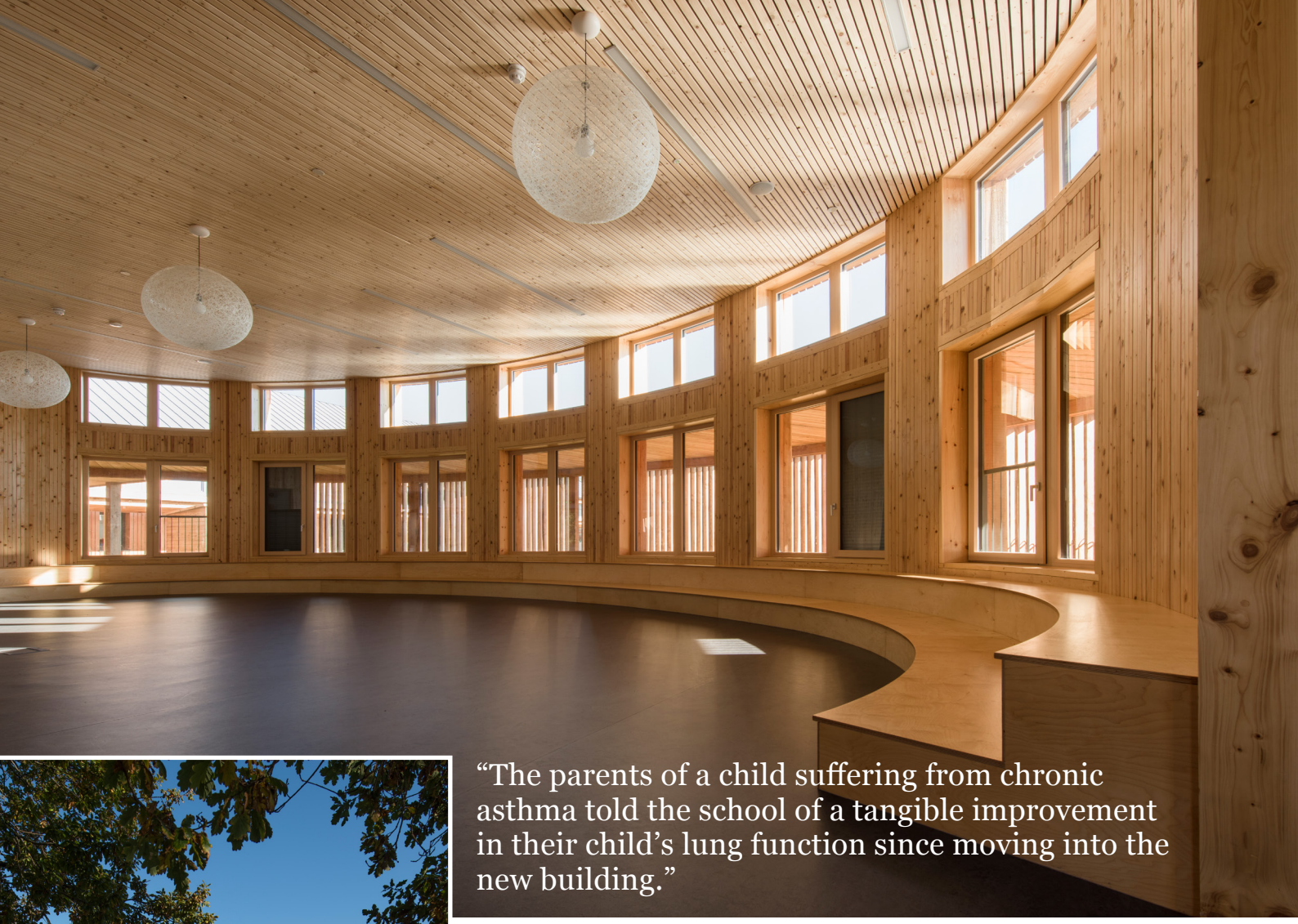
Green materials: External living wall, sedum naturally grown roof.

Welsh school fuses *passive & eco material innovation*

This new award-winning two-building extension to a primary school in the south of Wales delivers healthy, ultra low energy school buildings – one of which is passive house certified – while pushing the boundaries of timber engineering.

Words: Lenny Antonelli

Photos: Leigh Simpson



> “The parents of a child suffering from chronic asthma told the school of a tangible improvement in their child’s lung function since moving into the new building.”

Leading passive house design firm Architype built a name for itself in the education sector with the design of timber frame passive house schools in Wolverhampton. Two of these schools — Oak Meadow and Wilkinson — were previously profiled by Passive House Plus. Both projects featured super-insulated, airtight timber frame structures made in Cork by Irish manufacturer Cygnum.

For these new buildings at Burry Port Community School, design was a collaborative process between Architype and architects at Carmarthenshire County Council. The plan was to construct two buildings, each with an ambitious goal of its own. The new school building — to include four classrooms, other teaching spaces, plus staff and meeting rooms — would be built with a conventional timber frame system but meet the passive house standard.

The second curved ‘pod’ building — which would house performance and recreation spaces — would use an innovative and ecological timber frame method known as brettstapel. It would be built to basically the same spec, but without the specific goal of reaching passive house. The old school building would also undergo refit, which was largely cosmetic.

Andrew Tidy, architect at the council, explains that because they weren’t required to reach Breeam or any other green building standard, the local authority “took this opportunity to pilot the passive house standard as a rigorous and prescriptive low energy strategy.”

At an early stage, the project received funding from the timber industry group Wood Knowledge Wales (WKW) to explore the possibility of using low grade Welsh softwood for both structure and cladding. The project would offer “a visual demonstration of the capability and affordability of this low grade timber,” Andrew Tidy says, as well as being aesthetically beautiful.

The design team worked closely with wood scientists from WKW. “Welsh timber was at the heart of this project. Our wider goal was to help support and promote the use of Welsh materials and encourage growth and opportunity with the timber industry in Wales.” This goes hand-in-hand with the council’s responsibility to deliver “community benefits” through its building projects, which are 50% funded by the Welsh Assembly government, he added.

Specifying brettstapel for the Pod building would be highly ecological too. “Brettstapel is a method of solid timber construction using low grade timber that would otherwise end up in pallets, woodchip or fence posts,” project architect George Mikurcik of Architype says. Timber studs are stacked into panels which are held together with hardwood dowels — no nails or glues are used. The panel itself is the final finish, there are no internal linings.

For the Pod building, the brettstapel panels were fitted on the outside with 300mm Larsen trusses, which were fully insulated with Warmcel blown cellulose insulation. George Mikurcik says that taking a fabric-first approach with brettstapel was relatively straightforward once the team adopted a clear airtightness strategy. An 18mm layer of OSB applied to the outside of the panels was installed prior to the installation of the Larsen truss insulation zone, and serves as an airtightness and racking layer.

“Care is needed on site,” says Mark Smith, director of timber engineering at Cygnum, who manufactured the brettstapel system in their Cork factory. “Brettstapel is like putting together very expensive bespoke delicate timber furniture in a field when it’s raining. Much effort must be made to avoid it becoming marked or stained until the roof is on and the building is watertight.”

He adds: “It has little or no advantage or disadvantage over normal timber frame when it comes to airtightness, thermal bridging or insulation. A slight disadvantage [compared to a normal Cygnum timber frame] could be that we lose the benefit of insulation between the studs.”

Though it wasn’t built to passive house, the brettstapel building was constructed to a very similar spec as the passive house certified, timber frame school, though no airtightness test or PHPP analysis was done on the Pod building. The passive house school building, also known as the KS2 building, has timber frame walls featuring 400mm deep timber I-beams, insulated with Warmcel, while the roof has a similar structure with a zinc finish externally.

“The biggest challenges in meeting the passive house standard were slightly unfavourable form factor — lots of double height spaces in the KS2 building — and a relatively large number of external doors, which can be tricky in terms of airtightness,” George says.

The ground floor of both buildings features an insulated slab foundation system, while IFT Rosenheim certified windows from Internorm feature throughout.

The heating and ventilation design was kept as simple as possible for both buildings. Architype had learned from their previous passive house schools that overly sophisticated setups — building management systems, automated windows and the like — can be problematic in schools, where staff just want simple controls.

“Space heating has become a really non-critical issue in passive house schools,” says Alan Clarke of passive house consultancy Elemental Solutions, who advised on the heating and ventilation. Low space heating demand enables simple, minimal heating solutions — in this case, a single domestic condensing gas boiler in each building, delivering hot water to radiators, which are controlled by thermostatic radiator valves. “We have found this quick response system is suitable for the school environment where a quick warm-up is needed before the start of the teaching day,” George Mikurcik says.

“You can dump all the fancy controls,” Alan Clarke adds. “The people who run primary schools from day-to-day are not facilities managers.” In the Pod building the gas boiler also provides hot water, while in the passive school building decentralised electric water heaters do the job.

Some of Architype’s previous passive house schools featured building management systems that shut down the MVHR (mechanical ventilation with heat recovery) in summer, switching over to automated natural ventilation via the windows, and extract fans in the bathrooms. But Alan Clarke says this was overly complex.

At Burry Port, the team ditched the BMS and let the MVHR run all year around, with a summer bypass mode kicking in automatically when needed. One advantage of letting the MVHR run all year is that you can give occupants back total control over opening and closing windows — you don’t need to worry about air quality suffering if occupants forget to open them. “As we’ve got the MVHR ticking along in the background, we can say open the windows if you want, or don’t open them,” Alan says.

In addition to the MVHR, the passive house school building has a simple strategy for manual ventilation, with handle-controlled vents at low level in the classroom and actuator-operated windows higher up — the latter linked to simple on/off switches, with no automation. This simple system also avoids the capital and service cost to the school of a BMS.

But apart from energy and ventilation, what were the team’s design goals? For one, to make the old and new school buildings work together, creating a secure courtyard in between.

There was also an emphasis on simple materials — the untreated larch cladding, zinc roofs, low VOC materials and finishes inside. The aim, architect George Mikurcik says, was to create a vibrant and healthy teaching environment. “We have paid particular attention to acoustic design in order to create calm and comfortable spaces,” he says. As with several previous Architype projects featured in Passive House Plus, the ceiling finishes included Troldtekt acoustic panels – a cement-bonded wood product with numerous health and environmental certifications.

Architype’s consideration for sustainability starts from the ground up – including the ground floor finishes, which variously consisted of 100% biodegradable Marmoleum flooring from Forbo, which includes a mix of renewable natural materials and recycled content; Noraplan Ultra Grip rubber flooring, which is manufactured to strict ecological criteria; Paragon carpet tiles with 65% recycled materials & BRE Environmental ratings of A/A+ and a resin seal on the concrete floor slab.

Architype are among the most highly decorated architects ever featured in these pages, such is the breadth of envelope-pushing sustainable projects in their portfolio. This project recently added to the practice’s ▶

(above and left) The brettstapel system, an ecological method of solid-timber construction that utilises low grade timber held together with hardwood dowels, was used to form the curved walls of the Pod building, which will house the school’s performance and recreational spaces. The brettstapel system was manufactured in Ireland by Cygnum, using Welsh softwood.

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trophy cabinet, picking up three RIBA regional gongs from the Royal Society of Architects of Wales – the Welsh Architecture Award, the Sustainability Award, and the Property Architect of the Year award went jointly to Andrew Tidy and Architype's George Mikurcik. The judges citation praised an "extremely sensitive, very carefully considered building that focuses on health and wellbeing and sets the bar higher for the schools of the future." Further awards are possible too: the project has been shortlisted for the National Eisteddfod of Wales' Gold Medal for Architecture. Main contractor WRW has also been shortlisted for the Constructing Excellence in Wales Sustainability Award for the project, while Architype and Cygnum have been shortlisted for the educational building award at the Structural Timber Awards for the project.

The school has now occupied the new buildings for a year, though data from the first year of monitoring wasn't yet available at the time of going to print. But Andrew Tidy says feedback has been hugely positive. "The simple operation of the new buildings, minus a BMS, as well as the comfort benefits, have both been highly commended as a resounding success," he says.

But he does think building to the passive house standard added something to the cost. He adds, however, that it's difficult to gauge how much of this was down to lack of experience and market confidence — both of which should be temporary factors — and how much is down to more permanent costs, like passive house design. "This is still a relatively niche market in Wales," he says.

Because this was a complicated project, with a refurbishment element and two new buildings — only one of which was passive — it's not easy to tease out the extra cost of meeting the standard. Andrew estimates the passive building may have cost between 8% and 10% more than other new build schools in the area. But he says that given the complexities of the project, and the use of an innovative structural method, it's not the best basis for a comparison.

The council's next passive house projects may reveal more. Carmarthenshire County Council has committed to building two more passive house schools, one of which has recently started on site.

Andrew says that given the success of Burry Port, the council may look to adopt a more formal passive house policy, but it isn't quite at that stage yet. The local authority is, however, planning to train some of its staff to become passive house designers.

He recounts one story that illustrates how the new buildings have improved the learning environment for kids at the school. He says that in one instance the parents of a child suffering from chronic asthma told the school of a tangible improvement in their child's lung function since moving into the new building last September. "This is so encouraging, and some of the best feedback we have received," Andrew says. "Fantastic."

"I also feel we have captured the imagination of the children," he says, through "introducing practical and creative lessons in recycling and natural materials through immersing the workspaces with tactile and thought provoking design." This includes the use of recycled tyres, cellulose insulation, the larch cladding, and so on.

"The new buildings are a life-size lesson," says. "It's incredibly pleasing and inspiring for myself listening to them, on many an occasion now, enthuse about their 'new home'." ►

SELECTED PROJECT DETAILS

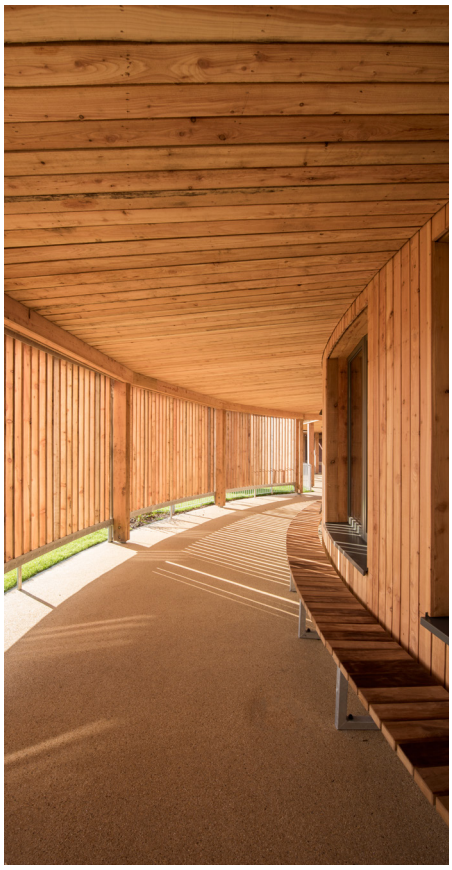
Client: Carmarthenshire County Council
Architect:
Architype & Carmarthenshire County Council
Main contractor: WRW Construction
Timber frame: Cygnum
M&E engineer: Troup Bywaters & Anders
Civil & structural engineer:
Bingham Hall Partnership
Energy consultant: Elemental Solutions
Passive house certifier: Warm
Mechanical contractor: Lorne Stewart
Cellulose insulation: PYC
Floor insulation: Jablite
Windows & doors: Ecohaus Internorm
Acoustic panels: Troldtekt
Sheathing boards: Hunton
Plasterboard: British Gypsum
Airtightness products: Siga / Pro Clima
Airtightness tester: Melin Consultants
Larch cladding: Pontrilas Sawmills
MVHR: Swegon
Roofing: VM Zinc/ Bauder
Marmoleum flooring: Forbo
Rubber flooring: Nora
Carpet tiles: Paragon
Cladding: Pontrilas Sawmill
Timber treatment: Osmo

(Below, clockwise from top left) The main timberframe KS2 building at Burry Port, seen here with Hunton Sarket T&G sheathing board; before larch cladding was installed over the timber battens; the Swegon Gold MVHR system; the curved walls of the brettstapel pod building; Larsen trusses in the KS2 building which were fully filled with Warmcel insulation;the stapled and sealed 18mm OSB on the inside forms the airtightness layer.

Want to know more?

The digital version of this magazine includes access to exclusive galleries of architectural drawings.

The digital magazine is available to subscribers on www.passive.ie



PROJECT OVERVIEW

Building type: One new passive house school building (KS2 block), and one new multipurpose building of brettstapel construction (not passive house but fabric-first principles applied), plus refit to existing school building

Location: Elkington Park, Burry Port, Carmarthenshire

Completion date: August 2015

Budget: £3.8m

Passive house certification: KS2 school building certified

Space heating demand (PHPP): 15 kWh/m²/yr (KS2 building)

Heat load (PHPP): 11 W/m² (KS2 building)

Primary energy demand (PHPP): 107 kWh/m²/yr (KS2 building)

Airtightness (at 50 Pascals): 0.6 air changes per hour (KS2 building)

Energy performance certificate (EPC): A24

Measured energy consumption: Not available yet

Thermal bridging: Thermal bridge free foundations using insulated concrete raft with thickened edges. Thermal bridges in the timber frame have been minimised/ designed out. No structure is penetrating the external envelope. External walkway along south canopy is free standing, separate from the main building. Roof overhangs are formed by cantilevered timber firrings, not affecting thermal envelope

KS2 PASSIVE HOUSE SCHOOL BUILDING

Ground floor: Insulated concrete slab foundation with locally thickened edges, using 250mm Jablite Jabfloor EPS250 and 250mm concrete. U-value: 0.08 W/m²K (including ground factor)

Walls: Partially factory-built timber frame with 20mm untreated Welsh larch vertical cladding externally, followed inside by 50 x 50mm untreated timber battens, 18mm Hunton Sarket T&G sheathing board, 240mm Larsen truss fixed onto 147mm load bearing timber frame, all fully filled with Warmcel blown cellulose insulation, 18mm OSB3 internal sheathing with taped joints (airtightness layer), 38mm service cavity and 15mm Megadeco internal linings. U-value: 0.103 W/m²K

Roof: VM Zinc Quartz-Zinc standing seam zinc metal roofing externally on 18mm WBP ply with breather membrane, 100mm timber firings vent zone, Pro Clima Solitex UD membrane with taped joints, 12mm Timbervent outer sheathing board enclosing prefabricated timber I-beam roof cassettes. Cassettes are made using 400mm deep timber I-beams, voids fully filled with Warmcel recycled cellulose insulation. 18mm OSB3 to underside of roof cassettes with taped joints (airtightness layer), 15mm Fireline board, variable depth uninsulated service zone and variable finish ceilings. U-value: 0.095 W/m²K

BRETTSTAPEL POD BUILDING

Ground floor: Insulated concrete slab foundation with locally thickened edges, using 250mm Jablite Jabfloor EPS250 and 250mm concrete. U-value: 0.08 W/m²K (including ground factor)

Walls: Partially factory-built timber frame with 20mm untreated Welsh larch vertical cladding externally, followed inside by 50 x 50mm untreated timber battens, 18mm Hunton Sarket T&G sheathing board, 300mm Larsen truss fully filled with Warmcel blown cellulose insulation fixed onto 18mm OSB with taped joints (airtightness & racking layer) on 140mm brettstapel load bearing timber frame, finished inside with OSMO Polyx oil. U-value not calculated

Roof: Bauder bitumen torch on roof membrane on 18mm WBP ply, 100mm timber firings vent zone, Pro Clima Solitex UD membrane with taped joints, 12mm Timbervent outer sheathing board enclosing prefabricated timber I-beam roof cassettes. Cassettes are made using 400mm deep timber I-beams, voids fully filled with Warmcel recycled cellulose insulation,18mm OSB3 to underside of roof cassettes with taped joints (airtightness layer),15mm Fireline board, 250mm uninsulated service zone and hit & miss acoustic timber batten ceilings. U-value: 0.095 W/m²K

BOTH BUILDINGS

Windows: Internorm passive house certified triple-glazed alu-clad timber frame composite windows, and Schueco triple-glazed aluminium passive house doors both supplied by Ecohaus Internorm. Glazing U-value: 0.6 W/m²K, g-value 0.6, overall U-value of 0.77 W/m²K

Heating: High efficiency condensing gas boiler & radiators with thermostatic valves, in each building. Hot water is via local electric heaters

Ventilation: Swegon Gold passive house certified MVHR units to both buildings, passive house certified heat recovery efficiency of 84%.

Green materials: brettstapel timber frame, recycled cellulose insulation in walls and roofs, timber frame using Welsh timber from sustainably sourced origin, untreated Welsh larch timber cladding, all timber products used are FSC or PEFC certified, OSMO natural wood protection oil for internal timber surfaces, a range of sustainable flooring including Forbo Marmoleum, Noraplan Ultra Grip rubber flooring & Paragon carpet tiles, and high efficiency LED lights throughout

West Cork passive house *raises design bar*

Photos: Gabrielle Morehead

The most celebrated architecture of the 20th century belongs firmly to the oil age, a heady mix of glass and steel and no need to have regard to comfort, given the availability of cheap fossil energy to fuel heating & cooling systems. But in the 21st century our buildings must adapt to and mitigate against climate change. That needn't mean compromising on design, as one West Cork passive house shows.

Words: John Cradden & Jeff Colley

There is no such thing as a passive house aesthetic. As long-time readers of Passive House Plus will recall, the 100 or so passive house projects featured to date in these pages have taken in everything from arts & crafts style new builds and chic minimalist modernism, to more prosaic affordable and speculative housing.

That said, it's undoubtedly true that simpler, more compact building forms make it easier and cheaper to build to the passive house standard – though this also applies when building to any standard – so the notion of the boxy passive house endures. Projects such as Wain Morehead Architects' latest certified passive house prove that in the hands of the right architect, meeting the standard can inform rather than restrict architectural expression.

One would expect there to be at least a few challenges in the construction of a large house in an exposed location and with such a distinctive design. Resolving some typical construction problems might involve a compromise of some kind, but when the house is being built to the exacting passive house standard, there is arguably less flexibility in this regard.

That was the heart of the difficulty facing clients Nick and Annie, architects WMA and the construction team behind this stunning home situated right on the edge of a bay in West Cork.

Architect and designer John Morehead's design for this 281sqm, two-storey four-bedroomed house included an expanse of floor-to-ceiling windows, particularly on the ground floor.

It's easy to appreciate just how critical these windows were to the success of the design, given how it aimed to maximize the views of the beautiful location without compromising on thermal performance.

The project ran into difficulties and delays due to significant quality issues with the original window supplier, who subsequently appointed a liquidator. Austrian manufacturer OPTIWIN stepped up to the plate with replacement windows, though the absolute success of the project was ultimately down to the willingness of everyone concerned, including the clients and the main contractor, to "dig deep" and remain focused on the end result, says Morehead.

The main contractor, Kieran Crowley of CHOM Construction, said: "It's been torture but I'm happy with the result. The house turned out very well. We do a lot of bespoke houses and we're not afraid of anything in that sense, but when the windows gave trouble it delayed the project."

The result that matters, of course, is the happiness of the clients. Having such a strong commitment to the passive house principle – and to sustainability in general – clearly helped Nick and Annie to keep them going during the period when things looked so bleak.

The couple, who held the passive house standard initially as a vague aspiration, bought a smallholding in 2008 and, during the lengthy planning application, the "opportunities to build to passive house designs economically and efficiently were increasing all the time, so we opted to go for fully passive", says Nick.

They had felt the pressure to make the final commitment "because technologies were moving on, prices were coming down, and a belief that we needed to do something to be energy efficient and build for the future of ourselves and the planet, so we did that".

From traditional to modern

Before they approached Morehead's practice, WMA, they already had successfully secured planning permission for a four or five-bedroomed house of a "much more traditional design", which had been designed by a local architect.

"We initially approached John with a view to building the original design, but to passive house standard and our research showed we could do it," says Nick. WMA reviewed the design but it was decided to start again from scratch, mainly on the grounds that it would be cheaper to do so, than adapting the initial blueprint.

"We let John loose with very much the same brief in terms of spaces that we wanted, the concentration of the views that we wanted of the area, to the West and the North, and to make the best of the site that we got."

Crowley says John's design and specifications, working with assistant architect Shane Fenton, were robust, although he wonders if it was necessary to have seven different wall types: "You won't find too many passive houses with seven different wall types." Morehead explains that there are three basic wall types in the building – cavity wall, timber frame and block on flat externally insulated with the Baumit system – with various rainscreens applied.

In addition, the structural design made things a little more difficult in terms of achieving airtightness. "But we got there," says Crowley.

Morehead's design called for the integration of the structural components into the overall building envelope, but doing this without having to battle with unforeseen thermal bridges required some innovative work by structural engineer, Conor Coburn.

He used a product called Parallam, a form of engineered wood made from clipped veneer strands laid in parallel alignment and bonded with adhesive. "We had very large timber members providing the cantilevers, with the whole building effectively designed like a diaphragm," said Morehead, who said Coburn "really thought outside the box and enabled us to get the large glazed areas underneath the overhang without too much structural interference."

Once the windows were finally in place, WMA and CHOM worked hard to push down the energy demands, but it helped that the energy load itself is quite low.

Active heating and – if required – cooling is courtesy of a Nilan Geo 6 geothermal heat pump, while a Nilan Compact P heats the hot water using the exhaust air as well as powering the ventilation system. The heating and ventilation systems – and the building's substantial PV array – were installed by sustainable energy specialists Energywise Ireland.

The PV system includes Sharp 250W polycrystalline panels with a SolarEdge inverter and power optimisers on each panel to increase output and offer full monitoring of the overall systems. "The ability to monitor the system arms the client with the knowledge of peak production times for electricity and therefore appliances can be timed to come on at these times, optimising performance," explains Energywise director Berth Sheehy.

The Geo 6 is fed by 600 meters of 40mm horizontal collectors – half buried in a field, half buried in tight coils strategically located in the garden – about 180m in two layers under the rainwater soakaway, and then 60m vertically coiled surrounding the concrete septic tank. A genuinely hands-on client, Nick installed the 600m of collectors and associated septic tank himself, and had the foresight to incorporate an element of the loop in the percolation area, and the drainage area where rainwater is falling. Sheehy points out an additional energy benefit resulting from Nick's approach. "The point is that there are gains to be had from rainwater – which at times has a higher temperature than ground water – and from waste energy from the house because of hot water usage."

Sheehy adds that the Nilan unit comes with an integral secondary 250L cylinder for domestic hot water. "This cylinder can be preheated by the Geo 6 but also has a back-up electrical element. We've designed the system so that any excess energy generated by the PV that's not required in the house is being dumped into this electrical element. Essentially you're pre-heating the water with this free energy that would otherwise be lost to the grid in the absence of a tariff."

Sheehy adds that although the building design minimised service penetrations to protect the airtight layer, continuous consultation with John Morehead also played a role. "It's impossible to foresee every scenario until you're onsite. So your architect and M&E contractors have to be in constant consultation during the project to ensure that any decisions that are taken aren't going to compromise the airtightness."

As well as remaining true to the original sketch design, this passive house also managed to achieve an A1 BER.

Landscape integration

On the outside, the house integrates well into its immediate surroundings, through a combination of landscaping and finishes. “We incorporated natural stone from the site to make [it] blend in a bit better,” said Crowley. It turned out to be an ideal building stone.

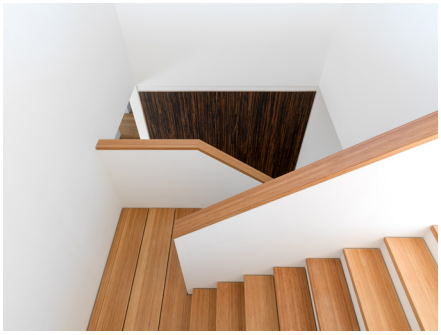
On the upper floor, the living area opens out onto a sheltered terrace. Morehead said: “The use of site-quarried stone and opportunity to have external access from the upper floor, introduced an interesting dynamic to how the property and the gardens can be enjoyed. The building was conceived as a series of folding plates straddling the rock outcrop, which integrated large overhangs to address solar shading requirements.”

Inside, on the ground floor, which is south and west facing, the spaces are big and bright with floor to ceiling windows and spectacular views out over the bay. The living room, dining room and kitchen are all open plan, with the staircase acting as a central element dividing and defining the spaces.

The sheer extent of glass in this project is undoubtedly atypical of the sorts of passive house designs that predominate in Ireland and the UK. Morehead points out that location – and a particularly mild microclimate in West Cork that’s approximately 2C higher than Dublin temperatures – opened up the architectural possibilities. “Because it’s so mild, it enabled us to integrate unusually expansive areas of glazing for a passive house,” he says. A little design ingenuity also made substantial south-facing glazing possible without fears of cooking the occupants in warm weather. “The diaphragm structure enabled us to have very deep overhangs relatively easily. We were able to throw the shackles off – to take in the expansive views – and allow for a little overheating. We were aware that we may have overheating in certain instances, but were comfortable that having mechanical cooling – from a geothermal source – driven by our PV array and supported by our stack ventilation, we could deal with it. That then means that in the winter – when the sun is low – we can utilise far more of the solar energy that’s available in this mild environment with this large expanse of glass.”

Morehead used site-specific climate files to influence the design, but rather than paying to have it dynamically simulated by the Passive House Institute, defaulted to Cork City Airport climate data for certification – one of the five regional climate sets for Ireland now included in PHPP (compared to Dublin Airport data only in Ireland’s national calculation methodology, Deap).

Having now moved in, what do the clients like the most about it? “The ambience, the



atmosphere and the comfort of the house; it's a very contemporary design, we love the design, but it's just a very comfortable space in which to live," says Nick. "The views are obviously a very strong point."

Morehead really likes the continuity of circulation that the stair placement has achieved through the ground-floor space. He is also happy with the penetration of sunlight throughout the dwelling, and the quality of finish that was achieved. "The workmanship was maintained at a very high standard and the contractors were able to embellish the designed details with their personal touches right across the trades."

Crowley admits it took a little longer to 'get it'. "It took a while to sink in, but I'm quite happy with the way it turned out. It is a good example of how you would make a modern design passive, because a lot of the houses they draw for passive standard are basic boxes. But he has a bit of shape and modern design to his."

Bamboo finishes

The clients, in tune with their interest in using sustainable materials where possible, opted to use bamboo for the flooring, which is harvested at five years old from China and supplied by a German firm called Bambeau Gmbh.

"But we ended up not just with bamboo flooring. All the internal woodwork, staircases, handrails, [built-in] wardrobes, cupboards, cabinets and breakfast bar, apart from the kitchen units, are all bamboo," says Nick. "It is a very sustainable, very durable, easily worked material which produces some aesthetically beautiful results." A weather-proof bamboo–polymer composite - Bambeau Econudo, consisting of 60% bamboo, 40% polymer resins, which the company claim are ecologically sound – was chosen for external decking.

In addition to supplying and fitting the Noblessa kitchen – certified to the Blue Angel's strict environmental criteria and featuring a 5 year warranty on all moving parts and a 7 year warranty on all finishes, with soft close mechanisms – Classic Kitchens used solid bamboo as the external finishes to the wardrobes, storage areas in hallway, dressing tables in two upstairs bedrooms and study desk. As Classic Kitchens' John Russell explains, the experience of working with the material attested to its solidity: "It's incredibly hard stuff so we had to get in specific cutters or blades – the resin in the bamboo was sticking to the blade and gumming it up. It's a very stable product too – whereas a lot of flat sheets for making furniture can move or warp when you cut them."

Sustainable appliances

Unlike the Irish or UK national calculation methodologies, the PHPP software used in the design and verification of passive houses includes unregulated energy use – or plug loads – meaning that appliance selection can be critical. This house doesn't disappoint. "We chose Neff ovens, partly because of their reputation for longevity," says Nick. "We hear stories of them still going 30 to 40 years on. And their power consumption is very energy efficient." Another factor was space: the ovens are facing the island – and the space between was relatively tight – so the Neff facility for "slide and hide" was critical. "As you open the oven, the door slides under." A Neff energy efficient induction hob was also installed – a modestly-sized hob flush with the seamless stainless steel worktop.

Nick and Annie also carefully selected a cooker extractor for aesthetic and energy performance reasons. "Rather than a cooker hood, which would lower the ceiling, and ruin the effect of the floor to ceiling windows, we opted for a Smeg extractor which glides up from an oblong panel in the worktop when you switch it on. It's flush with the worktop when not in use." The Smeg unit includes high performance carbon filters – so the warm air from the extractor is being filtered to such a high standard that it can be recirculated into the room. The MVHR extraction is concentrated on the kitchen and bathroom in particular. "This means any cooking smells are contained within the kitchen," says Nick.

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A Liebherr vertical 345L freezer was chosen, which Nick says is completely frost free – using about 130 kW per year of electricity. A low energy Liebherr larder fridge was also chosen – with controlled humidity Biofresh drawers. "I have a head of broccoli that's lasted two weeks," says Nick. The appliances are completed with a high efficiency Bosch dishwasher and washing machine – both of which use about 4 litres of water per wash.

The washing machine sits in a utility room, in the single storey section, and a raised tower of about 1.6m was included to take two dolly-style kitchen ceiling drying racks. At the top of the tower there are two extract vents for the MVHR system to draw air through the tower, aided by two remotely openable clerestory windows to assist with drying on a fine day. "We dry two loads of laundry overnight without going outside," says Nick, adding that the returned energy from the wash – with warm wet clothes – is going back into the heat recovery system – so being retained in the house or used to generate hot water.

The clients are also very pleased with the specialist exterior lighting – which was supplied by Shane O'Byrne of As Light – and general lighting by ERCO, which rely on low energy LEDs throughout in both cases.

The net result of all of this is a building that's not only extraordinarily energy efficient but easy on the eye. Passive houses feel different to ordinary buildings, which is one of the reasons the International Passive House Days – and the opportunity to experience passive houses first hand – are such a central part of the Passive House Institute's efforts.

Professional photographer Gabrielle Morehead – who is married to architect John Morehead – visited the house on a stormy June evening to photograph it for this article. "It was quite calm when I arrived down but soon, the weather turned. I got caught in the rain when I was shooting, and made a mad dash back into the house." The sensation of being in the house had a palpable, visceral effect. "It's very hard to put your finger on it when you're trying to pinpoint exactly what you're experiencing. The only thing I can come up with is that it's calm and it gives you a sense of peace. There's no drama. The drama's outside.

For John Morehead, a standard such as passive house, in the hands of a skilled architect, can help to reconcile the seeming conflict between design for beauty's sake and the needs of occupants. "What's the point in having nice architecture if you're uncomfortable in it?" Morehead knows discomfort all too well – his practice also offers services to assist owners of problem buildings. "We come across places that are miserable – where people are frozen to death or fried. We're accommodating people – we're not on an architectural ego trip."

SELECTED PROJECT DETAILS
Architectural services & passive house design: Wain Morehead Architects
Structural engineer: Construct Engineering
Main contractor: CHOM Construction Ltd
Quantity surveyors: Richard Leonard & Associates Ltd
Mechanical consultant, heating & ventilation supplier: Nilan Ireland
Mechanical & PV subcontractor: Energywise Ireland
Electrical subcontractor: John O'Sullivan
Airtightness tester: Collins Energy Consultants
EWI system: Baumit
Bonded bead insulation: Warmfill
Mineral wool insulation: Rockwool
Wood fibre insulation: Ecological Building Systems
Thermally broken wall ties: Ancon TeploTie, via Longs
AAC blocks: Quinn Lite
PIR insulation: Xtratherm
EPS & additional PIR insulation: Kingspan
Airtightness products: Ecological Building Systems/Siga
Windows and doors: OPTIWIN
Lighting: ERCO Lighting Ltd
Lighting controls: Legrand
External lighting: As Light Ltd
Heating controls: Heatmiser/Nilan
Sanitaryware: Soaks Bathrooms
Kitchen design & supply: Classic Kitchens
Appliances: Bosch, Liebherr, Neff & Smeg, via Dwyers Electrical
Bamboo flooring, decking and furniture finishes: Bambeau
Roofing: Soprema Ireland
Dry lining board: Fermacell
Screed: Sika Ireland
GGBS: Ecocem, via Keohane's Readymix
Bore drilling: Harte Divining and Boring Ltd

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(Above) Pictured from WMA's team are (l-r) Jennifer Kenefick, John Morehead, Shane Fenton, Cathal O'Boyle and Alexandra Nedela.

(clockwise, from left) Slab penetration detail with insulation around pipes; wall section showing Quinn Lite blocks and 250mm cavity with TeploTies to minimise thermal bridging; insulation detail at footing to prevent thermal bridging; roof service cavity with ducting, Nilair ducting housed in a service cavity inside the airtight layer; roof build-up features 120mm Xtratherm Thin-R XT insulation over vapour control layer.

PROJECT OVERVIEW

Building type: 281 square metre detached two-storey dwelling

Location: West Cork

Completion date: March 2016

Budget: Undisclosed

Passive house certification: Certified

Space heating demand (PHPP)*: 10.4 kWh/m²/yr

Heat load (PHPP)*: 9.92 W/m²

Primary energy demand (PHPP)*: 60.1 kWh/m²/yr

**The above PHPP calculated values are provisional and based on Cork climate data*

Energy performance coefficient (EPC): 0.153

Carbon performance coefficient (CPC): 0.156

BER: A1 (23.7 kWh/m²/yr)

Airtightness: 0.59 ACH at 50 Pa

Thermal bridging: Externally insulated generally, all junctions thermally modelled, all external structural items thermally isolated from thermal envelope ensuring continuity of thermal envelope. All window reveals insulated. Raft foundation eliminates the need for any penetrations in the insulation at ground level, and ensures that thermal continuity is maintained between the wall and slab insulation. Y-Value based on ACDs and numerical simulations 0.0262

Ground floor: Insulated raft foundation consisting of 200mm Aeroflor EPS300, 250mm concrete, 80mm Kingspan TF70 insulation (containing ventilation ductwork channels), 60mm Sika Viscocrete screed (containing underfloor heating), Bambeau Solid 3SF bamboo flooring. U-value: 0.09 W/m²K

WALLS

Stone wall: 200mm stone from site externally, over 100mm rendered blockwork, 250mm Warmfill Super Silver bead cavity insulation, 215mm blockwork, 15mm airtight plaster internally. U-value: 0.116 W/m²K

ETICS wall: Baumit Nanopor render system externally, over 250mm Kingspan Aerowall, rendered 215mm blockwork, 15mm airtight plaster internally. U-value: 0.121 W/m²K

Timber walls: Larch cladding or rendered cement board externally, over 50 x 50mm treated battens and counter-batten, Tyvek UV facade membrane, 60mm wood fibre board, 190x50mm timber stud with full fill Rockwool flexi,18mm OSB3, Pro Clima DA membrane taped and sealed, 50mm service cavity insulated with Kingspan TW50, finished with 15mm Fermacell board internally. U-value: 0.111 W/m²K

Roof: Soprema Flagon TPO membrane, over 120mm Xtratherm Thin-R XT insulation, vapour control layer, plywood deck, 300mm timber I-joists laid to falls (200mm air cavity & 100mm Rockwool Flexi), Intello Plus membrane, service void, plasterboard ceiling. U-value: 0.118 W/m²K

Windows: OPTIWIN triple-glazed, alu-clad timber windows with argon filling achieving overall U-value of 0.83 W/m²K

Heating system: Nilan Geo 6 unit provides primary space heating with a COP of 440%. Air to water heating is provided by the Compact P by Nilan.180L water storage with a 250L buffer tank

Ventilation: Nilan Compact P Geo heat recovery ventilation system, Passive House Institute certified to have heat recovery rate of 77%

Electricity: Ten panel (16.2m²) solar photovoltaic array – eight at 30°, two on the flat later added to achieve A1 BER target – with average annual output of 2104 kWh/a

Lighting: Low energy LED lighting throughout. Generally ERCO LED Wallwasher, ERCO Starpoint downlighter/ spotlight. Exterior lighting integrated with overall lighting design

Green materials: Fermacell dry lining board, 27% GGBS in concrete, all timber PEFC/FSC certified, along with FSC-certified bamboo products.

Stylish low energy house **squeezed into South Dublin garden**

Built in the back garden of two architects, this simple-but-elegant brick house in Blackrock faced the twin challenges of an extremely tight site and less-than-ideal orientation, but with rigorous attention to detail it came close to passive house levels - while delivering impressively low actual heating costs.

Words: John Hearne & Jeff Colley

Photos: Imageworks

"Data from the heat pump reveals the house cost €118 to heat in its first year of occupancy."

A new build in Blackrock, Co. Dublin shows how to do low energy, open plan living on a really, really tight site.

Architect couple Liz and Frank Hughes live on Prince Edward Terrace in a protected house dating from 1842. Frank, now retired, explains that after the children had left, the four-bedroom house began to feel a bit too big.

"It's also high maintenance," he explains. "We have timber windows that have to be painted, and a slated roof. But we also had a store at the end of the garden which gave us access to Brookfield Terrace, behind our street. We decided, why not lodge for planning permission to build a house down there?"

The couple sought and received planning permission for a three-bedroom, open-plan house fronting onto Brookfield Terrace. Passive House designer Liz, who took charge of the design of the new house, explains that onsite restrictions meant the ideal southern orientation wasn't an option.

"Instead, the bedrooms and bathrooms face east, and then the living area faces west. As a result we were penalised in the passive house software, PHPP, but on reflection, a full south orientation may have given us too much solar gain. As it stands, overheating is not an issue." To help mitigate the slightly increased power load as a result of the sub-optimal orientation, the couple plan to install a photovoltaic array on the roof.

The decision to go for a timber frame structure was informed partially by environmental concerns and partially by the advantages of off-site manufacture. "You get greater quality control because you're building the panels in a factory setting," says Liz, "plus you get rapid onsite construction. Almost 80 per cent of the wall can contain insulation, and there's enhanced vapour transfer technology in it as well."

The frame came from Wexford Timber Frame Homes, which is run by Ivor Gilbert. He says that one of the key challenges on the build was simply craning the panels into place in what was an exceptionally tight space. Having a highly skilled, highly motivated crane driver became very important.

"Access was a very big thing," he says. "We had to work between three different sets of cables and the crane only had 100mm tolerance in the turn. Had it been any tighter, we wouldn't have been able to do it."

The timber frame panels themselves are twin stud. Typically, Gilbert's panels are manufactured with cellulose insulation pumped into the cavity, but Liz Hughes opted instead to use solid Thermo-Hemp insulation batts. Ivor Gilbert says that as ▶

a result, the panels themselves had to be manufactured in a slightly unusual way.

“Fitting the insulation into the twin wall was a challenge because we wanted to avoid cutting the insulation as much as possible. Half the panel was made and insulated, then the second half of the twin wall was made on top of that, with the full piece of insulation in between.”

Liz Hughes explains that she sought this build-up primarily because she was familiar with the Thermo-Hemp product. She and Frank had used it in remedial works on their existing home, and liked the fact that it was both rigid and breathable. Aesthetics also required remarkable precision in the manufacture of the timber frame. Ivor Gilbert says that Frank and Liz wanted the window opes completed without cutting any of the bricks in the external leaf. That meant that the opes in the frame had to match the brickwork to within the millimetre.

“We make whatever somebody wants,” he says. “There was a vast amount of contact between ourselves and the client, making sure every detail was tried and tested before we made anything.”

That level of forethought was also necessary when it came to negotiating existing garden walls that had to be retained on either side of the new building. “We had to make sure that moisture didn’t get from the existing garden wall into the new structure,” says Liz. In addition, the design and build teams had to ensure that the cavity between the external leaf and the timber frame was properly ventilated. The solution was to install a gutter on top of the garden walls on either side of the structure, and ventilate the cavity from those walls upwards.

The spacious, open-plan living room steps down into the back garden via large, sliding glass panels. The design team had hoped to create a continuous glazed wall at this elevation, but at the time, there was no product with sufficient thermal properties to make this vision a reality.

“We just couldn’t get a sliding, folding screen that met passive standards,” says Liz. “We hoped that it would become a garden room when the screens were folded back but that wasn’t going to happen. In the end, we installed two substantial sliding door screens from NorDan that we’re very happy with.”

The airtightness result fell just at the limit of the passive threshold, at 0.64 ACH at 50 Pa, as measured by airtightness consultants 2eva.ie. Ivor Gilbert reports that installing the engineered timber I-joists which comprised the rafters resulted in a tear in the airtightness membrane.

“The I-joists are very long, they’re actually the full length of the house. During the build, we had a person stationed at each end to move them up into position. But as they were moved along, they caught the airtightness membrane and cut it.” The problem was revealed at the first blower door test and was quickly remedied, resulting in a much better airtightness result on the second test.

The house is heated by a Daikin Altherma air-to-water heat pump with an inverter capable of modulating down to the low outputs required for near passive builds. This feeds into underfloor heating in the ground floor, and Irish-made Solorad hydronic heaters – a low water content fan assisted system – to the first floor, with Heatmiser programmable timed zoned controls. Each Solorad is its own zone, explains Solorad’s Rory Farrelly. “There are two temperature sensors on each radiator – one on the coil which turns the fans on when the water reaches 26C, the other on the return air. It takes the temperature of the air in the room, and once it reaches the desired temperature each rad turns off.”

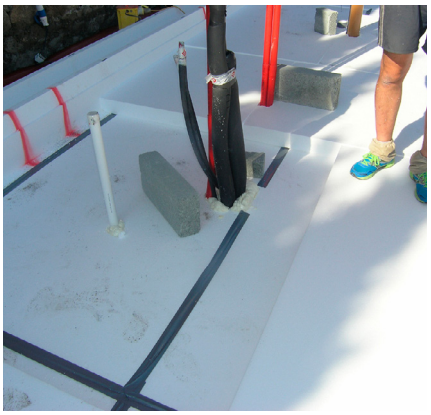
Liz and Frank are eager to praise Keltic Renewables — who supplied and installed the heating and ventilation systems — and contractor Kevin Doyle of Doyson Construction, for the success of the project. Liz says of Kevin: “He is experienced in passive house design, and he also understood the science of the building. His attention to detail and his organisation of things was impressive.”

Though Frank and Liz remain in the original family home, they plan to move into the new house within the next couple of years. Right now, their daughter and her boyfriend are living there. She reports that the house is very easy to live in, and that the air quality is excellent. Because all space and water heating comes from the air-to-water heat pump, there’s only one bill to pay. It’s cheap to run — and once the PV panels are installed, it will become cheaper still.

When Passive House Plus asked if this low running cost claim could be quantified, Diarmuid Jones of Keltic Renewables came up trumps. The Daikin Altherma heat pump that covers the building’s thermal loads logs electrical input and thermal output – including separate figures for heating and hot water. In the first 12 months to June this year, the 130 sqm home consumed 741 kWh of electricity to generate 3,119 kWh for space heating. The heat pump’s actual space heating output – at a measured coefficient of performance (COP) of 4.21 – works out at just under 24 kWh/m^2/yr – within a hair’s breadth of the value calculated by PHPP. “We’re running

(below, from top) Erection of the timber frame, with the gable panel craned into place; ridge beam in place; I-beams laid out in front part of roof; Intello vapour barrier and Gutex Ultratherm insulation fixed to underside of roof beams;

(left) The Supergrund foundation system features three layers of EPS 100 insulation, with the bottom layer shown here with joints taped, and foam filling around service penetrations; (below left) The taped second layer of EPS, before channels are cut to contain heat recovery ducts and then the top layer of 100mm EPS laid over; (below), installation almost complete of the reinforced steel mesh for the concrete slab, with underfloor heating also installed.



the system on weather compensation between 25 and 40C flow temperatures for heating," said Jones. As is typically the case with passive and near passive buildings, domestic hot water is the bigger load. The heat pump used 1,295 kWh of electricity to generate 3,609 kWh of hot water – a measured COP of 2.79. But what does this mean in terms of running costs? According to Jones, based on an assumed average unit price of €0.16C per kWh, the house is costing €118 per year to heat, with an additional €207 for hot water. Not too shabby at all.

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SELECTED PROJECT DETAILS

Architect: Liz Hughes Architect
Main contractor: Doyson Construction
Timber frame: Wexford Timber Frame Homes
Quantity surveyor: Neil Ryan Quantity Surveying & Cost Consultants
Mechanical contractor: Keltic Renewables
Electrical contractor: Jim Dunne Electrical
Airtightness testing: 2eva.ie
Wood fibre & hemp insulations: Ecological Building Systems
Roof insulation: Knauf
Ground floor insulation: Kingspan Aerobord
Airtightness products: Ecological Building Systems
Windows & doors: NorDan
Roof windows: Velux
Floor slab design: Tanner Structural Design
Civil engineering: Dennis Campbell Engineer
Passive house consultant: Building Life Consultancy
BER: 2eva.ie
Heat pump: Keltic Renewables
MVHR: Keltic Renewables
Hydronic heating system: Solorad
Lighting: Hicken Lighting
Fibre cement slates: Tegral

PROJECT OVERVIEW

Building type: 130 square metre detached two-storey timber frame house

Location: Brookfield Terrace, Blackrock, Co Dublin

Completion date: April 2015

Passive house certification: Not certifiable

Space heating demand (PHPP): 23 kWh/m²/yr

Heat load (PHPP): 12/W/m²

Primary energy demand (PHPP): 113 kWh/m²/yr

Airtightness: 0.64 ACH at 50 Pa

BER: A2 (42.93 kWh/m²/yr)

Thermal bridging: Entire timber frame insulated to cut thermal bridging

Ground floor: Kingspan Aerobord Supergrund insulated floor system including ring beam to design and reinforcement as per Kingspan Aerobord specification, with 100mm thick reinforced concrete slab and 3 x layers of EPS/100 insulation, on 30mm sand blinding, on radon barrier on 200mm blinded and compacted hardcore. U-value: 0.114 W/m²K

Walls: Gables have 20mm smooth sand/cement plaster with K-Rend finish to 100mm concrete block outer leaf. Walls elsewhere have 102.5mm brick outer leaf. All walls to have 50mm ventilated and drained cavities. Pro Clima Solitex Plus breather membrane laid over 12mm Spano Durelis Populair board, fixed to 300mm deep twin-stud factory made timber frame with 300mm Thermo-Hemp between studs. Pro Clima Intello Plus breathable vapour barrier fixed to inner face of studs to provide a complete seal. Service space has 40mm Thermo-Hemp behind 12.5mm skimmed plasterboard internally. U-value: 0.125 W/m²K

Roof: Tegral Riverdale fibre cement slates on 50x38mm sw battens fixed to 50x38mm sw counter battens providing ventilated air gap, on Pro Clima Solitex Plus breather felt, on 50mm Gutex Ultratherm insulation fixed to 350 x 47mm timber I-beams with 2 x layers of 180mm Knauf Earthwool MetStud insulation between beams. Pro Clima Intello Plus breathable vapour barrier fixed to u/s of beams. Service space has 40mm Thermo-Hemp insulation behind 12.5mm skimmed plasterboard ceiling. U-value: 0.084 W/m²K

Windows: NorDan N Tech Passive triple-glazed aluclad pine windows with low emissivity glass and argon filled cavities. Overall U-value: 0.7 W/m²K

Roof windows: Velux triple-glazed roof lights with solar-powered actuators triggered by rain sensors. Overall U-value: 0.89 W/m²K. Additional insulating value from automated black out blinds.

Heating system: Daikin Altherma air-to-water heat pump with factory insulated hot water cylinder. SPF: 418 % when tested to EN14511-2:2000(electric). Underfloor heating to ground floor, Solorad hydronic heaters to first floor

Ventilation: Vent-Axia Sentinel Kinetic Plus with Nilair ducting system. Thermal efficiency 91%. Specific fan power 0.52 W/l/S (Sap Appendix Q)

Green materials: Timber frame, wood-based Gutex Ultratherm and Durelis Populair boards, Thermo-Hemp insulation board, NorDan alu-clad pine windows from PEFC sources, Knauf Earthwool MetStud made with ECOSE technology, a formaldehyde free binder derived from renewable materials.

Upgrading a historic home to the passive house standard typically means leaving the façade untouched to preserve the building's historic appearance, but the team behind this fully passive retrofit in Kensal Green took a totally different approach.

Words: Kate de Selincourt

Photos: Mike Massaro

Sensitive passive retrofit *transforms Victorian North London home*

In an ordinary street in an ordinary part of north-west London, stands a very ordinary-looking Victorian terraced house, one of thousands like it.

Except it is not ordinary at all. In fact, thanks to an epic retrofit to full passive house standard, it is one of the most energy efficient houses in London – and probably one of the most energy efficient Victorian houses in the country.

The impetus for the project was the vision of the property owner, Peter Land. He planned to sell the house, but before he did so, wanted to make the house as energy efficient as possible.

“As an environmental scientist I am acutely aware of the need to reduce carbon emissions, so I feel I have a responsibility to cut the emissions from any property I have an influence over,” he explained.

“It made financial sense to do up the house before selling it. Because of the way London house prices have changed I realised that I could justify spending quite a bit on the improvements, and still recoup that in the increased market value. Hopefully I would effectively be able to achieve a ‘free’ low energy retrofit – and feel happy that I had done the right thing with the property.”

The original plan was to retrofit to the Enerphit standard, “but as I was going to have to borrow money anyway to get to Enerphit, I thought ‘in for a penny, in for a pound’ — why not go the extra distance and go for full passive house.”

Peter admits that he “slightly naively” hoped full passive house certification would add a premium to the sales price as well.

He brought in architects Eco Design Consultants and contractor Bow Tie Construction, who advised him that though Enerphit would undoubtedly be simpler, passive house would be achievable too.

As a mid-terrace dwelling the form factor for the house is relatively good, though rear and loft extensions mean it is closer to 2.3 than the 1.7 that you might get with the simplest terrace form. However, there were significant losses through the thermal bridging and the glazing.

As is inevitable in a retrofit, thermal bridges were significant but again relatively fixed as they form the structure. Extensive analysis also confirmed that the floor junctions and party wall connections in particular contributed significant thermal bridging losses.

In a retrofit like this, the glazing openings are also relatively fixed, especially to the front. To the rear, north-facing window openings were to be retained to bring light into the back of a deep kitchen. The kitchen also sports east-facing floor-to-ceiling double glass doors, seemingly de rigeur in a London retrofit (and unquestionably very nice to have) but expensive both in terms of cash and energy losses.

The orientation and fixed window opening sizes, plus shading from neighbouring buildings, meant that little solar gain would be available to balance heat losses. Internal gains were limited too for the purposes of PHPP calculation.

“The house was modeled and certified under PHPP version 8. For a house of 110m2, PHPP assumes an occupancy of 3.2, but for a four-bedroom house this may be an underestimate,” Patrick Osborne of Eco Design explained. Nonetheless the calculations allowed some useful heat from internal gains.

Taking all of these factors together, very low U-values needed to be achieved in the walls, floor and roof in order to reach the passive house standard.

However to begin with, the planners said that external insulation would not be permitted. The team then explored the option of rebuilding the front wall with external wall insulation, but set back to retain the original line of the façade – which would have been difficult and expensive. But as Peter Land explained: “The architect would not take no for an answer and after some digging around confirmed that what the planners were saying was not a good interpretation of the planning laws.”

The team went back to the local authority and the external wall insulation was clarified as a ‘permitted development’. Peter Land said: ““In the end the local authority was happy to agree to the plans, even though we were adding an unusually thick layer of insulation, provided the appearance was maintained. I’m very proud of the precedent we set for the area.” ►

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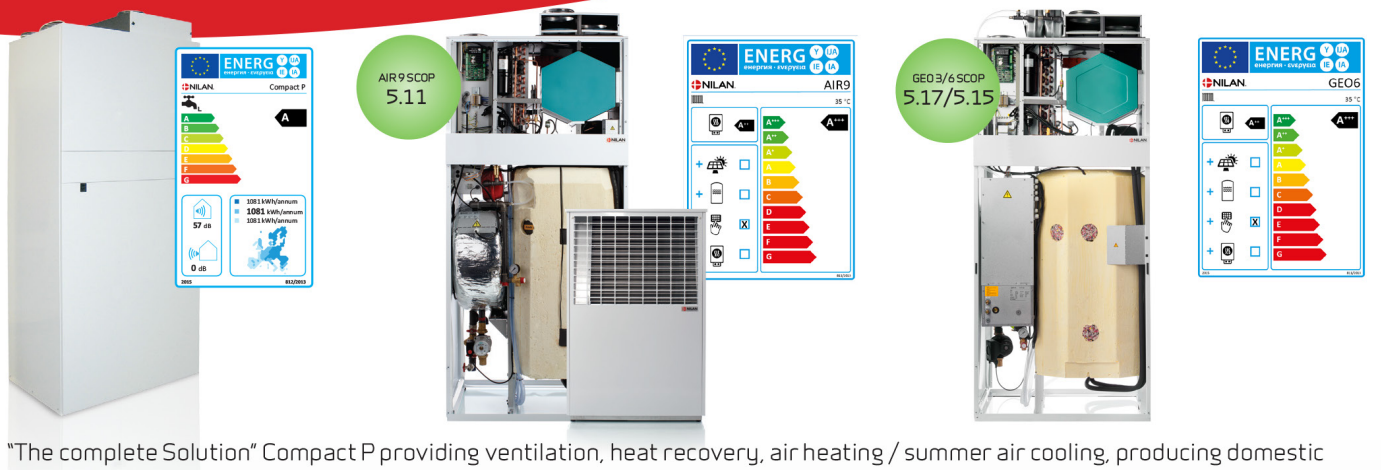

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The choice between internal and external insulation, "was a combination of the building fabric issues, such as the moisture risks with internal wall insulation [IWI] if we were to insulate to the required levels, and the reduction in useful floor area with IWI," Patrick Osborne explained. "Given that we could get a better U-value with external wall insulation, plus the fact that there would be no decrease in space —which would affect the property value — it made sense to pursue this option."

Nonetheless, given the very low wall U-values required (around 0.08W/m^{2}K) in order for the house to meet passive house, insulating externally was not easy — 250mm of external wall insulation (EWI) was needed, which Bow Tie managing director Rafael Delimata described as a "builder's nightmare" to install.

The fixings into the existing structure were very difficult given the depth of the insulation, and the fact that to reach that depth three layers of board were needed. Fixing the insulation around the two-storey bay window at the front of the house was a particular challenge.

As Rafael Delimata explained, there were also difficulties in sourcing the right components: "We could not use standard anchors because the EWI was so thick, so we had to source specialist longer ones."

"A risk we always highlight with projects going for an extremely high specification is the need to source specialist components. These often involve long lead times – then sequencing can start to go wrong. When subcontractors get held up because something has not arrived, they get very fed up."

The experience highlighted the importance of close collaboration between builder and designer. Where possible, Rafael Delimata says, Bow Tie try to persuade designers to stick to standard components and tried and tested techniques, as this reduces the risk of unforeseen delays and extra expense.

"Working through these issues with the contractor is important, so in future projects we would ensure that we go through this process thoroughly," Patrick Osborne added.

The EWI at the front was finished with render, and the string courses were replaced using Sytex profiles, matched to the profiles of the originals. Patrick Osborne was happy with how it turned out. "It was quite easy to do and we think it has given a great end result," he said.

Insulation elsewhere in the building was not as technically challenging – but it was certainly thorough. For example, unusually for a retrofit with external insulation, the window reveals were also insulated internally. With EWI there should be no issues with cold internal surfaces, but in order to pare a little more off the heat losses through the window frames, a layer of insulation was added to the internal reveals, butted up to the inside of the frames.

At loft level, party walls were insulated (internally, obviously!), as they adjoin an unoccupied, unheated space. Party wall returns were also internally insulated to one metre, to tackle the thermal bridging at the junction.

The roof too achieved a very low U-value of below 0.1 W/m^{2}K. New 150mm roof rafters were insulated with Icynene spray foam insulation, with 120mm insulation boards above. "Rafael installs the spray foam, and I was impressed with the continuity – with boards there is a risk of gaps and then air movement, so this should represent an improvement in actual building performance," said Patrick Osborne.

With most of the fabric having external insulation, moisture was not as much of a concern as it can sometimes be in the retrofit of old buildings. The fabric was also, happily, already very dry. "There were no signs of moisture in the fabric of the existing building, although there was some mould in the bathrooms caused by poor ventilation. We felt that as the majority of the insulation was external, and outside the airtightness line, the moisture risks due to interstitial condensation would be reduced," Patrick Osborne explained.

Nonetheless care had to be taken, particularly with the loft space. Because this had internal insulation, the U-values couldn't be quite as ambitious as the externally insulated walls, in order to prevent the risk of interstitial condensation on cold masonry. The insulation here was also lined with a Pro Clima Intello vapour control membrane, Patrick Osborne ▶

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added: “We felt this would be protecting the timber as best as we can, given that moisture from construction could adversely affect it.”

The flat roof to the back extension potentially presented a tricky thermal bridge, because of the need to fix a gutter to a corner that was externally insulated, down the wall and across the roof. Contractor Bow Tie however came up with a solution. “Rather than inserting a timber, which would have created a thermal bridge, we bonded ply to the insulation with adhesive, to make what was in effect an on-site constructed SIP. This was able to support the necessary edging and guttering – and is something our roofer already knew how to do,” Rafael said.

The floor was excavated to the (somewhat shallow) foundation level, insulated with 300mm of Ecotherm PIR insulation laid on a damp proof membrane, and topped with a polished concrete slab holding the underfloor heating pipes. The thermal bridging from the ground where the walls ‘bypassed’ the floor insulation was ameliorated by adding insulation at the base of the walls to form oversized skirting boards, lengthening the cold bridge path though the brickwork as much as possible to minimise heat loss.

Airtightness strategy

Achieving passive house airtightness is a huge challenge for any retrofit, and even more so when, as in this case, the structure is shared with neighbouring buildings.

It helps a great deal to identify the main air leakage paths as early as possible in the project, so that the most effective airtightness strategy can be built in from the start. The air leakage paths need a pressure test to identify them, but when air testing in a Victorian building like this, fabric leakage may be overshadowed by losses through the windows and sash boxes, making it harder to spot the other issues.

Bow Tie’s solution to this was to remove the old windows early in the job, and build and make airtight plywood boxes for the new windows. “Once windows have been sized up, we construct ply boxes to receive the new windows, and make them airtight. We parge around them, and at the front we close them with ply for security, sealed with silicone, at the rear we put in polythene to admit some light – and seal that too,” Rafael explained.

“This then enables us to do some preliminary air-testing. We rent a fan for a couple of weeks and use our own smoke machine – the same kind that is used for discos! At this stage it isn’t about getting an expert measurement, it’s about finding out where the leaks are.”

These tests showed leaks in the plaster, the joints between old and newer parts of the structure, and in particular, through the party walls. “This told us that with an external airtightness strategy there was no chance of meeting the passive house airtightness level – and even Enerphit could not be guaranteed, so the strategy was changed to use an internal air barrier.”

Because the air barrier was internal, great care had to be taken with the junctions where internal structures joined the walls: such as the floor joists and staircase. Where individual timbers penetrate the masonry they were taped and the sealed into the parge coat. With the staircase, the entire structure was sealed to the wall with a structural grout, then parged. Although it required a bit of careful work, being able to do this also enabled the team to retain an attractive Victorian feature.

Overheating risk

Although the building is shaded both by surrounding buildings and by the 250mm window reveals, overheating risk was still a concern, especially in the light of the east/west orientation and the tall glass double-doors at the back. However modeling showed that even using very conservative assumptions, based on natural ventilation alone, the overheating stayed below the 10% of hours over 25C required for passive house certification.

Patrick Osborne explained: “The Paul Focus 200 does have a summer ventilation setting, but not a full bypass, and as there is no provision for this mode in PHPP, the overheating calculations were based on natural purge ventilation through the windows and top floor rooflights.

“We were careful with our assumptions, basing them on restricted hours of window opening, and overnight opening only of those windows that could be opened securely — for example, not those above a flat roof.

“On this basis the hours over 25C did come close to the 10% allowed. In practice however, more flexible window opening and the summer ventilation setting of the MVHR should make the performance better.”

Passive house vs Enerphit

The project had an overall budget of £230,000, which works out around £2,000 per square metre. Although it would doubtless have been out of the question on this site, Patrick Osborne agrees that a new build passive house – fitted out to a similar standard — would not necessarily have cost more, and might even have cost less. ▶

(below, from top) Specially constructed airtight ply boxes were installed to receive the new windows, and also allow for preliminary airtightness testing to more accurately reveal air leakages elsewhere in the house; airtightness detailing around windows; fixing the external insulation around the two-storey bay window at the front of the house was a particular challenge.

(below, clockwise from top left) the ground floor was excavated and rigid insulation placed around the perimeter to cut thermal bridging here; airtightness taping around joist ends; new roof rafters insulated with Icynene spray foam insulation; airtightness detailing to the roof, with Pro Clima Intello membrane under internal battening.

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But aiming to upgrade to Enerphit rather than full passive house would certainly have been cheaper and simpler, while still offering a great improvement over the existing building, he says. It would also have been easier to achieve, given the slightly less exacting airtightness requirements, and the likelihood that a more standard specification for insulation would have been feasible.

Rafael Delimata agreed: "The client would have been better off in terms of money and time spent on the project had they opted for Enerphit, but they wanted to go full passive house, so we were determined to help them achieve that, and we did.

Although Peter Land's original hopes of securing a passive house retrofit "for free" were disappointed, he is extremely proud of what he, Eco Design and Bow Tie Construction achieved. "We have created something magnificent," he says.

As well as giving a young family a supremely comfortable home that will greatly reduce their carbon footprint, there are much wider lessons to be shared from this project – including from what did not go exactly as planned.

The project gave the team valuable insight into the relative difficulties and financial implications of achieving Enerphit versus full passive house. "Learning from this project, it will be easier to compare the two standards for future projects and give options," Patrick Osborne believes.

He goes on: "There was nothing technically insuperable about achieving passive house standard on this retrofit, using knowledge, materials, and techniques that are available now. The key part of the equation missing for retrofitting large numbers of these quite common Victorian terraces, is the finance mechanism.

"The Green Deal helped fund this retrofit, but with the Green Deal now cut, and the mooted changes to reduced rate VAT for energy efficiency measures, this becomes more difficult."

From a financial and a technical point of view, deep retrofit like this could come down in cost with a street-at-a-time approach. As Patrick Osborne pointed out, "if the whole terrace had been retrofitted, the task would have been very different, and potentially a lot easier."

With everything in the UK up in the air after the EU referendum, it is hard to know what support for retrofit might be available in future. However, Peter Bonfield, who is advising the UK government on retrofit policy, has been clear about the need for more careful design, and better construction standards.

Projects like this are building an invaluable bank of knowledge – at the design stage, where calculation gives insights that could be shared across so many similar buildings, and on site, in the meticulous attention to detail that demonstrates how care and attention can bring about a leap in the performance of the finished building. Projects like this show that occupants of a typical Victorian terrace house can enjoy every bit as much comfort you'd expect in a brand new 21st century passive house.

SELECTED PROJECT DETAILS

Client: Peter Land
Architect, energy consultants & project management: Eco Design Consultants
Contractor, M&E engineering: Bow Tie Construction
Structural engineering: Watson Hallam Structural Engineers
Project management: Eco Design Consultants
Passive house certifier: Warm
MVHR + windows & doors: Green Building Store
Airtightness testing: Aldas
External insulation contractor: Make My Home Green
Phenolic insulation: Kingspan
Airtightness products: Ecological Building Systems, via PYC Systems
Roof & floor insulation: IBB
Wastewater heat recovery: Recoup
Roof windows: Fakro
Heating controls: Heatmiser
Lighting: Arrow Electrical

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PROJECT OVERVIEW

Building type: 111 sq metre terraced Victorian brick townhouse

Location: Kensal Green, London

Completion date: April 2016

Budget: £230,000 inc VAT

Passive house certification: Certified

Before (estimated): 363kWh/m²K

After: 15 kWh/m²/yr

Heat load (PHPP):

Before: 126 W/m²

After: 15 W/m²

Primary energy (PHPP): 106 kWh/m²/yr

Airtightness (at 50 Pascals): 0.54 ACH

Thermal bridging: Party wall returns with insulation to 1m, and internal walls with insulated skirting board details. All thermal bridges individually calculated to provide psi values for PHPP calculation

GROUND FLOOR
Before: Uninsulated 100mm concrete slab to kitchen. U-Value: 4.64 W/m²K. Front rooms and corridor uninsulated suspended timber floors. U Value: 4.33 W/m²K

After: Insulated concrete slab with 300mm Ecotherm PIR. U-value: 0.075 W/m²K

WALLS
Before: Double-brick 215mm solid wall. U-value: 2.14 W/m²K

After: Existing solid brick wall with 250mm Kingspan Kooltherm K5 rigid phenolic insulation and render finish. U-value: 0.077 W/m²K

ROOF
Before: 100mm rafters to pitched and flat roof sections, both with 50mm EPS insulation. U-value: 0.68 W/m²K

After: New 150mm roof rafters were insulated with Icynene spray-foam insulation, and 120mm Ecotherm Eco Versal rigid PIR insulation above, with 50 x 25mm battens and tiles over. U-value: 0.097 W/m²K

WINDOWS
Before: Mix of single-glazed windows at back and poor performance aluminium double-glazed front units. Double glazing assumed with Ug value: 2.9W/m²K, U-value: 2.2W/m²K

After: Green Building Store Ultra passive house certified triple-glazed windows, with glazing U-value of 0.65 W/m²K and a frame value of 0.84 W/m²K

Heating system: Fully designed and commissioned by Bow Tie Construction's M&E division. The existing Greenstar boiler was kept and relocated, connecting to a new underfloor heating system on the ground floor, and radiators for the first and second. Recoup PIPE+ HE wastewater heat recovery system fitted to shower

Ventilation: Paul Focus 200 MVHR unit supplied by the Green Building Store, certified efficiency of 91%

Electricity: 4kWp solar PV array

"We wanted to build something healthy and sustainable for us as a family."

1950s Cork City house reborn as healthy low-energy home

The deep retrofit of this two-storey 1950s house in Cork City transformed a draughty, poorly-insulated dwelling into a comfortable, low-energy home for one family – coming close to the Enerphit standard in the process.

Words: Ekaterina Tikhoniouk

Photos: Maann Photography

Being a wind power engineer, Steven Lang has naturally always had a keen interest in energy. He travelled twice to Antarctica to conduct research on the release of carbon dioxide from air trapped in the ice, set up his own wind energy consultancy Westwind Energy Engineering in 2001, and has been following passive house and energy efficient building for a number of years.

So, when Steven and Clare Kennelly bought a poorly-insulated 1950s house in Cork City with the intention of retrofitting it, the only option they really considered was passive house. "We wanted to build something healthy and sustainable for us as a family," says Clare.

The original house is a concrete-block cavity wall build with a timber roof. A previous owner had filled the cavity with blown insulation and added an extension to the rear. The complexity of the build meant that airtightness was always going to be the biggest challenge.

Knocking down and rebuilding the house was mentioned during the design process, but according to Steven: "We did not want to waste a good structure. Plus we thought of the whole embodied energy side of things and the amount of waste that would have to go to landfill." Instead they decided to aim for the Enerphit standard.

The house's cracked single-glazed windows and poor insulation weren't the only problems the team identified. The layout of the ground floor didn't work well, so Steven and Clare decided to merge some of the small, cramped rooms on the ground floor into a large open-plan living space. They also chose to add a new single-storey 18 square metre extension to the front of the house, which would serve as Steven's office.

"Steve spent a lot of time researching, reading, meeting providers, discussing different systems," says Clare. Passive house architect Loïc Dehaye, who has ten years of experience in energy efficient builds, was appointed as the architect, and Jim Davis & Co was selected as the main contractor. While Jim Davis & Co had never worked on a passive house project, the team had a lot of experience with airtightness and were eager to cut their teeth on a passive house retrofit.

As Steven and Clare had opted for a deep retrofit, it was decided that the house would be completely gutted. However the roof was in good condition and was kept, and the internal plasterwork on the concrete block walls was also left in place.

Steve Davis, co-director of Jim Davis & Co and the foreman who supervised the retrofit, says he knew from the outset that it would be difficult to reach the airtightness necessary for Enerphit (1.0 air changes per hour at 50 Pascals of pressure) due to the complexity of the building. ▶

(above) The original house, and rear extension, before the retrofit and after the project was completed; (below, clockwise from bottom left) new plaster around joists ends; foil-backed insulation behind lead flashing to minimise thermal bridging where the pitched roof extension meets the externally insulated existing walls; cavity wall with full-fill Xtratherm insulation board and Ancon TeploTies; (below right) Xtratherm floor insulation detailing at split level.

One complication emerged when the team started work on site to find that the original wall cavities were not fully insulated. The cavity had been pump-filled by the previous owner, but the insulation had not reached parts of the cavity due to a ring-beam at first floor level. “It was some surprise for the clients,” says Davis. “The cavity had been pumped from the outside, so we pumped it from the inside to make sure that everything was filled exactly.”

Not wanting to lose any floor space, Steven and Clare chose to insulate the main house externally with platinum EPS. The main roof was left cold, but the mineral wool insulation above the ceiling was increased to 400mm. Meanwhile good quality Kingspan Styrofoam insulation was found in the existing extension, and this was reused when insulating the ceiling in the main part of the building. A Pro Clima Intello vapour control membrane and more rigid insulation were added inside the existing extension’s timber roof.

The new extension was built at the front of the house from two leafs of concrete block fixed by Ancon TeploTie low thermal conductivity wall-ties, with 120mm of Xtratherm rigid insulation filling the cavity fully. The new extension’s flat zinc roof was insulated with 400mm Ecocel cellulose insulation – manufactured locally from recycled paper – between and over the ceiling joists.

All the existing single-glazed windows were replaced with triple-glazed Velfac aluclad timber units. A new radiator and pipe system was installed and the building’s 15 year old boiler replaced. A highly-insulated storage tank was also installed in a former toilet, while three solar hot water panels were installed on the roof. After much deliberation, Steven and Clare chose a Nilan heat recovery ventilation system, which is Passive House Institute certified to have a heat recovery rate of 88%.

As with any low energy retrofit, the building team can make or break the success of the build. Foreman Steve Davis brought in a lot of sub-contractors who had experience with airtightness and Enerphit, but says he still had to keep a close eye on everyone, “Every sub-contractor, every worker who went near the house... you have to watch with every single item that goes inside there,” he says.

However, it’s not always possible to catch every mistake. Despite Davis’ best efforts and diligence, he explains that one sub-contractor punctured the airtightness membrane on the foundation slab. “We had to go and fix that back up again,” he says, “which is very difficult once you’ve started.”

Blower door tests were conducted by airtightness specialists 2eva.ie. The first air test, conducted before they began slabbing, hit 1.4 air changes per hour, and a second test was scheduled. “We brought in a second guy to stay with us with the blower on,” Davis explains. “Anywhere there was a leak, we then went and tried to fix it. We were going around the whole house searching out every leak we could possibly find.”

While the clients, architect and contractor took all the steps and precautions they could, the third and final air test conducted just before the clients moved in hit 1.78 ACH, falling short of the Enerphit target. However, the retrofit did boost the building’s BER from a D2 to an A3.

Architect Loïc Dehaye discusses the possible reasons why the project didn’t reach Enerphit. “There was an obvious problem due to the complexity of the build. As well as that, we didn’t touch the existing plaster on the interior of the main walls of the house. So we were relying on the existing plaster to be airtight, and I think the plaster probably wasn’t good enough,” he says.

Steve Davis believes that problems were caused during the retrofit by “packed cavities and things cold bridging, and at the joints between the different builds”.

While the clients were initially somewhat disappointed that they hadn’t reached Enerphit, Steven Lang says that, at the end of the day, they were not chasing certification. Their main goal was to create a home that would be energy efficient and offer excellent indoor air quality and comfort, which they did.

The couple’s gas bills have averaged €630 annually post retrofit. Having never lived in the house before the retrofit, Steven and Clare can’t compare what it was like before and after. However, prior to living here on Orchard Road, the family lived in a redbrick two-storey house built in the early 1900s, and Clare says: “You couldn’t compare it! In this house, you put on the heat for an hour and it stays warm for the whole evening. We’re in June now and I’d say I haven’t had the heating on since March or April.” And, despite having a significant amount of glazing on the south-facing side of the house, there hasn’t been any overheating reported yet.

Clare says she’s definitely seen a significant decrease in family illnesses — especially coughs — since they moved into the renovated house. “I don’t think anyone in this house has been on an antibiotic in the two years we’ve been here,” she says. “I think we’re a much

healthier family living here. We've got excellent air quality in this house and I do think it's making a big difference."

"It was definitely worth it all," Steven concludes. "We have low bills, and a very comfortable and healthy environment to live in."

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SELECTED PROJECT DETAILS

Clients: Steven Lang & Clare Kennelly
Architect: Loïc Dehaye Architects
Main contractor: Jim Davis & Co
Civil & structural engineer: James Kelly Associates
Energy consultant: Westwind
Airtightness testing: 2eva.ie
External insulation contractor: Insulex
External wall insulation: Kore
Additional wall insulation: Xtratherm
Additional roof & floor insulation: Kingspan
Cellulose insulation: Ecocel
Low thermal conductivity wall ties: Ancon
Airtightness products: Ecological Building Systems / Siga
Windows: Velfac
Solar thermal: Clean Energy Ireland
MVHR: Nilan Ireland

PROJECT OVERVIEW

Building type: 179 sqm detached house from 1950s. Deep energy retrofit with two-storey and single-storey front and rear extension including attached garage

Location: Orchard Road, Cork City

Completion date: July 2014

Budget: €322,000

Passive house certification: Enerphit standard used as guidance but not achieved

BER

Before: D2 (272 kWh/m²/yr)

After: A3 (65.71 kWh/m²/yr)

Space heating demand (PHPP): 31 kWh/m2/yr (based on climate data from Cork Airport)

Heat load (PHPP): 15 W/m²

Primary energy demand (PHPP): 111 kWh/m²/yr

Measured energy consumption (after retrofit): 67 kWh per/m²/yr (annual average July 2014 - Jun 2016)

Energy bills (after retrofit):

Gas - €630 average per year (July 14 - June 16)

Electricity - €880 average per year (July 14 - June 16)

Airtightness (at 50 Pascals, after retrofit): 1.78 air changes per hour

FLOOR

Before: Timber suspended floor. U-value: 2.0 W/m²K

After: 250mm Xtratherm rigid board insulation with 120mm concrete floor slab and timber floor finish. U-value: 0.081 W/m²K

ORIGINAL WALLS

Before: Concrete block walls with pump-filled 70mm cavity. U-value: 0.47 W/m²K

After: 140mm Platinum Kore EPS insulation and mineral render finish externally, 55mm blown bead insulation into existing cavity, wet plaster internal wall finish. U-value: 0.15 W/m²K

EXISTING EXTENSION WALLS

Before: External leaf of concrete block followed inside by ventilation gap, breathable rainscreen, plywood, 150mm timber frame stud, 100mm rigid insulation between studs, plasterboard internally. U-value: 0.28 W/m²K

After: As above with addition of 80mm stud filled with rigid board insulation, service cavity internally lined with Pro Clima Intello vapour membrane, plasterboard internally. U-value: 0.135 W/m²K

New extension walls: Double-leaf concrete block walls, cavity full-filled with 120mm Xtratherm rigid insulation, Ancon TeploTie system, wet plaster finish internally. U-value: 0.17 W/m²K

ORIGINAL ROOF

Before: Concrete roof tiles externally on existing timber roof, followed underneath by ventilated attic space, with 200mm mineral wool insulation on flat between joists, plasterboard ceiling internally. U-value: 0.20 W/m²K

After: Concrete roof tiles externally on existing timber roof, followed underneath by ventilated attic space, with 400mm mineral wool insulation on flat between joists, service cavity internally lined with Pro Clima Intello vapour check, plasterboard ceiling internally. U-value: 0.10 W/m²K

EXISTING EXTENSION ROOF

Before: Existing metal roofing, laying on battens, followed underneath by breather membrane (weather barrier), 18mm plywood decking, 80mm rigid board insulation between joists, sloped ceiling. U-value: 0.29 W/m²K

After: Existing metal roofing, laying on battens, followed underneath by breather membrane (weather barrier), 18mm plywood decking, 80mm rigid board insulation between joists, lined with Pro Clima Intello vapour check, 80mm rigid insulation, plasterboard to sloped ceiling. U-value: 0.13 W/m2K. Use of Aerogel insulation on the steel post internally and externally

New Extension roof: Zinc roofing followed underneath by breather membrane (weather barrier), 18mm plywood decking, ventilated air gap, 400mm Ecocel cellulose insulation between joists and over joists, service cavity internally lined with Intello vapour check, plaster board ceiling internally. U-value: 0.10 W/m²K

Windows & doors

Before: Single-glazed, timber windows and doors. Overall approximate U-value: 3.50 W/m²K

New triple-glazed windows: Velfac triple-glazed timber aluclad windows and doors. Overall U-value: 0.92 W/m²K

HEATING SYSTEM

Before: 15 year old gas boiler & radiators throughout entire building

After: Baxi Megaflo Boiler, 15 high efficiency A-rated radiators throughout sized in accordance with PHPP

Solar hot water system: Three Prestige 8210 solar thermal collectors, 300 litre hot water cylinder with 100mm insulation

VENTILATION

Before: No ventilation system. Reliant on infiltration, chimney and opening of windows for air changes

After: Nilan Comfort CT300 heat recovery ventilation system — Passive House Institute certified to have heat recovery rate of 88%, fan power 0.72w

Green materials: Ecocel cellulose insulation, Forbo Marmoleum floor finish bathrooms, solid timber kitchen fittings. Engineered oak wood floors through rest of house.

Photo: Marc Detiffe

How Brussels went passive

Ten years ago Brussels had some of the most energy inefficient building stock in Europe — now it boasts a groundbreaking policy that means all new buildings in the region must be passive. How did the city do it?

Words: Lenny Antonelli

Brussels may be known as the home of the European Union — and it may be regarded as a modern and cosmopolitan city — but back at the start of the 2000s, the city-region's buildings were among the worst performing in Europe in terms of energy efficiency. Most of the city's buildings were built prior to 1970, at a time when energy was cheap, climate change was unheard of, and nobody cared about insulation.

In 2001, about 250 megajoules (MJ) of energy was lost per square metre of wall in Brussels — compare that to about 50MJ in Sweden, and 100MJ throughout much of Europe. But as climate change came on the radar, and the European Union was preparing its first directive on the energy efficiency of buildings, the city had to act.

With poor building stock and limited potential for large-scale renewable energy projects— no coastline for offshore wind, no hydropower resources, little land for biomass — Brussels turned towards energy efficiency. In 2004, the city elected a new coalition government led by the Socialist Party, with strong representation from the environmentalist Ecolo Party too. Crucially, Ecolo's Evelyne Huytebroeck was appointed minister for the environment and energy.

The ministry was looking for new policy ideas, and architect Sebastian Moreno-Vacca was one of a few early advocates who emphasised the passive house standard to the new government. "It started from the bottom up," he says of how the government was persuaded to embrace the standard.

The government announced a competition to stimulate the sustainable building sector. The Batiment Exemplaire — or Batex for short — offered funding of €100 per square metre to buildings that met a series of environmental targets. Anyone could apply — self builders, large corporations, private developers, even the city authority itself. Ninety percent of funding went to the building contractor, 10% to the developer. The fund was available for both new build and renovation projects.

Passive house advocates like Moreno-Vacca pushed the standard, arguing that the passive house design software PHPP made for a simple way to compare the energy efficiency of different projects and decide which should be awarded funding. The passive house standard was subsequently written into the Batex criteria — meeting it wasn't essential, but developers were advised to use it as a reference point.

"The passive house concept was an existing high performance standard, with a developed calculation method, so it seemed a logical choice," says Joke Docx, director for energy at Brussels Environment, a government agency. "No other high energy performance standard came into our mind."

Projects applying for the funding had to meet a series of other environmental goals too — they had to be as close to zero emission as possible; prioritise environmentally friendly materials, water efficiency and biodiversity; demonstrate a high standard of architecture and design; and use simple and replicable technologies that were cost-effective and offered good payback times, rather than being too hi-tech.

The applications rolled in, and not even the property crash could slow them down — in fact applications only increased as developers sought any financial help they could get in tough economic times. "The more the crisis deepened, the more people went for it," says Moreno-Vacca.

By 2009, Brussels had 80,000 square metres of passive house buildings planned or built.

With funding from the government, the local passive house associations the PMP and PHP helped designers and builders to get to grips with the standard free of charge.

The coalition government returned, and promised to keep the Batex programme going. “They said okay, let’s do another year — and after two or three years everybody was fulfilling passive house,” says Moreno-Vacca. ““It’s really the market that went to passive house.”

The government also funded a quarterly magazine, Be.Passive, that published clear and simple information on the passive house standard. Ad campaigns and outreach events aimed to promote and demystify passive house. People living in passive buildings, many of them low income residents, were asked to serve as passive house ambassadors. The passive house associations, in conjunction with different industry groups, started to offer free training.

Spurred on by the certainty that the programme would continue, local manufacturers started to develop their own passive house components, meaning developers no longer had to import specialist products at extra cost. Low energy windows with better solar factors came on the market as architects sought to design office buildings with lots of glass, while still meeting passive house criteria on overheating.

“Since the beginning of our policy in 2006, we have seen the emergence of more architects and contractors with experience in passive house and the availability of more [passive] products,” Joke Docx says.

By the time the Batex programme ended in 2014, it had funded the construction of buildings covering 621,000 square metres — and more than half of this was passive. In 2012, 16% of construction activity in Brussels was Batex funded, generating €319m in turnover and creating over 1200 jobs.

Few Batex projects actually sought full certification from the Passive House Institute, though. Moreno-Vacca says because developers were getting financial support to meet the standard, it was hard to convince them to pay for a separate cert.

And by 2012, the city was already planning to make passive house mandatory, based on the success of the Batex programme. The previous year, the regional government passed a law mandating that from 2015, all new buildings and major renovations in the city would have to be passive houses.

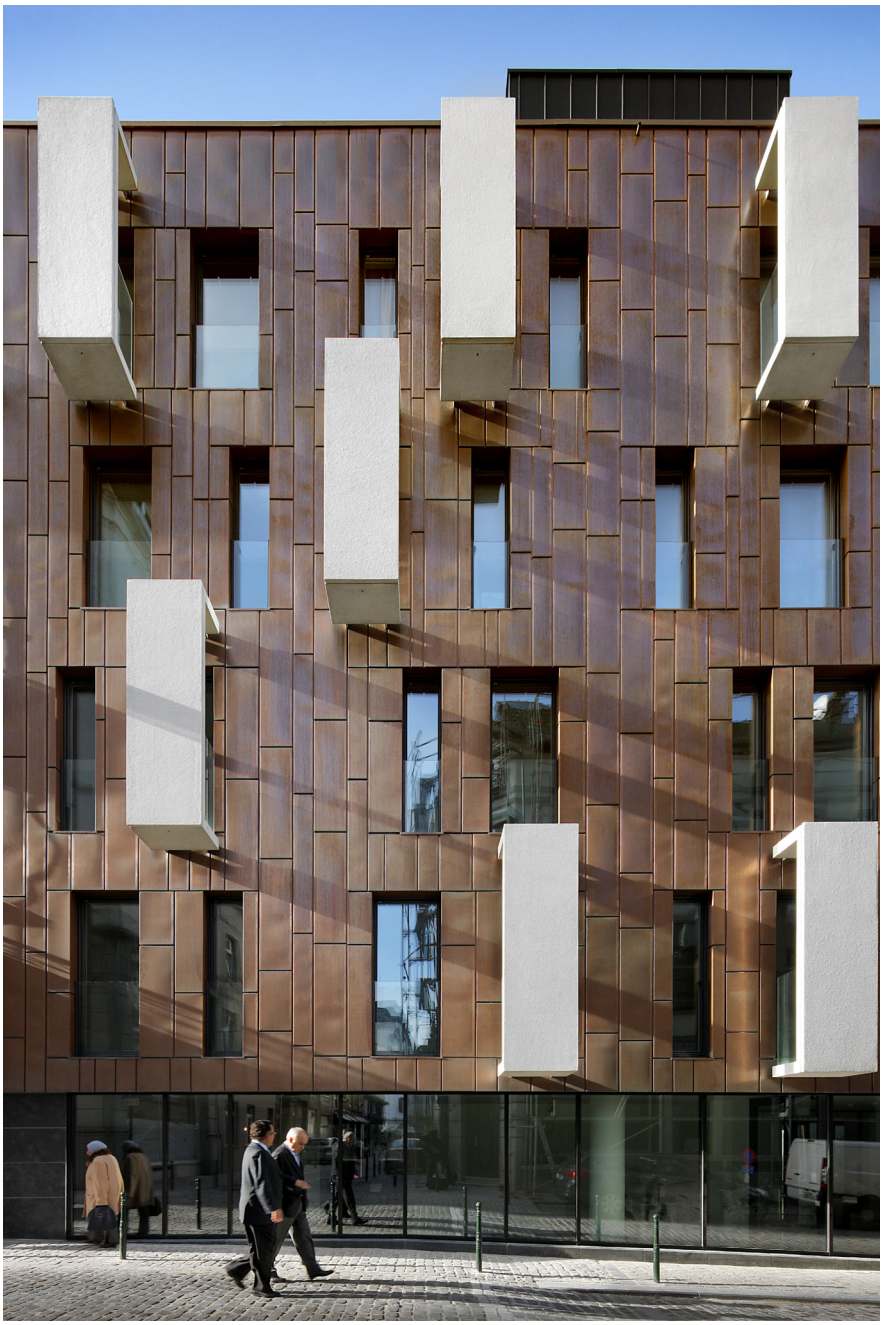
Moreno-Vacca says the government mainly passed the law, “because they didn’t know what they had voted for!” No feasibility studies were actually carried out in preparation for it, he says.

Soon, lobby groups representing architects, contractors and the property industry started to object. They said the airtightness target (0.6 air changes per hour at 50 Pascals) would be too onerous and expensive to meet, that more than one type of ventilation should be permitted (the rules only permitted mechanical ventilation with heat recovery), and that many buildings would struggle to meet the standard if their orientation and shape wasn’t right.

Industry representatives sat down to negotiate with government officials and passive house advocates. But campaigners fighting the passive house corner had something big on their side — the Batex programme itself. There didn’t need to be a feasibility study when Batex had acted as one giant, eight-year long trial for the passive house standard in Brussels.

“After a couple of years and after several calls for projects, we had experience, and real life passive projects,” Joke Docx says. “This gave us proof that it was technically and economically feasible.”

The vast majority of builders had been able to meet the airtightness standard fine under Batex, using simple masonry construction with internal wet plaster. Plenty of architecturally ▶



Photos: F Dujardin

(opposite) High profile passive buildings in Brussels include Architectesassoc.’s 10,000 sqm office building for electricity transmission system operator Elia; MDW’s mixed use office and apartment building in Ixelles; and Conix RDBM’s Pépin development, a 4290 sqm office, gallery and apartment building.

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striking passive buildings were funded by the programme too — it didn't just mean building boring compact boxes.

Cost surveys also showed Batex-funded passive house buildings didn't cost much more either — €1,503 per square metre for a standard home, and €1,514 for a passive home. For non-domestic buildings, it was actually cheaper to build to the passive house standard, while passive refurbishments cost just 5% more than the non-passive equivalent.

When talks concluded, the standard was mostly kept intact. As per the passive house standard, space heating demand would be 15 kWh/m^2/yr. The airtightness requirement would be 0.6 air changes per hour, but its introduction would be delayed until 2018. The overheating requirement would be even tighter than the Passive House Institute's standard — indoor design temperatures could only rise over 25C 5% of the time. Designers could specify their own ventilation system of choice, so long as they met minimum air flow requirements (though in practice specifying heat recovery ventilation has been the only way to meet the space heating target).

But what's more, the same standard would also apply to retrofit projects that upgraded more than 75% of a building's fabric. Smaller retrofit projects would have to upgrade their individual building elements to passive levels, too. The city would use its own building energy compliance software — the equivalent of Sap in the UK or Deap in Ireland — to determine if a project met the standard, because of a belief that European rules meant it couldn't use a commercial package like PHPP (ed. – solicitor Philip Lee argues that this is not the case, citing Dutch case law which demonstrates that a commercial software can be specified – even in the more legally onerous area of public procurement – providing an "or equivalent" caveat is added). Moreno-Vacca says that about 75% of buildings that meet the 'Brussels Passive' standard also meet the requirements of PHPP.

A new coalition government came to power in 2014, and some lobby groups saw this as an opportunity to get rid of the law. But the legislation had years of momentum behind it, and the new government decided to leave the law in place, to at least see how it worked out. January 2015 came and went. "It was supposed to be the end of the world and nothing happened," Moreno-Vacca says. "Now it's the market who's leading."

He says that cost surveys have revealed that the same factors make building in Brussels cheap or expensive, regardless of whether it's passive or not. For one, collaboration between designers and contractors from the early stages of a project keeps costs down — as does letting Brussels builders use the traditional masonry-and-plaster techniques they have been familiar with for decades.

He also says that designers and contractors have kept control over costs by learning how to meet the stringent requirements of the local standard — but without going beyond them. This could mean allowing a few cold bridges, or some double glazing on large-scale buildings, so long as the overall building still meets the requirements. "A lot of tricks came out of the market," he says.

Earlier this year the government, under pressure from lobbyists, removed the airtightness requirement. But Moreno-Vacca doesn't believe it matters — meeting the space heating demand target without excellent airtightness is very difficult anyway, he says. And airtightness is a much cheaper way of getting your energy demand down than putting in loads of extra insulation. "Now this is coming from the market. This again is an unexpected consequence," he says.

Passive house has become normal in Brussels. "When people buy these apartments, some don't know it's a passive house — it's just a building." Because every new building is built as a passive house now, and many are large office or apartment buildings where occupants change frequently, it's not possible to give everyone an induction — this obliges designers to make their buildings simple and easy to maintain.

Now Brussels is looking to take a broader view of the sustainability of its built environment, by integrating whole life cycle assessment into the way it regulates buildings.

"Passive house is not the goal, it's a step," Moreno-Vacca says. He talks about a future of zero energy buildings, of self-sufficient buildings. "Can you do a building that regenerates the environment?" he asks — one that captures CO_2, one that adds biodiversity to the environment?

It's been almost ten years since the first phase of the Batex programme, when the city first started to embrace the passive house standard. Brussels now has over one million square metres of passive buildings, either built or approved for planning.

"We were frontrunners ten years ago, but now everybody is doing that," Moreno-Vacca says. "So what are we doing next?"

(top to bottom) An illustration of Baumschlager Eberle's new passive HQ design for BNP Paribas; A2M's passive offices and crèche for Commune de Forest; and A2M's 8700 sqm Belvue Hotel.

Photos: Filip Dujardin

Fabric First Institute to upskill trades for passive house

The achievement of exacting quality standards such as passive house lives or dies based on standards of workmanship. Even if the fabric is built to passive house airtightness levels, subsequent work to run building services through the envelope can needlessly undermine performance. Jackie Richards of Whole House Energy describes a ground-breaking new Eastern region training initiative aiming to get the industry out of its siloes to produce better buildings.

Energy policy over the coming years will challenge the construction industry in delivering more energy efficient building stock. To do so with increased effectiveness is going to be key to business profitability, housing affordability and energy efficiency. Critical national and regional housing shortages and rising levels of fuel poverty mean it has never been more important to deliver high quality homes to our communities at a commercial scale.

With the planned investment of £300 million worth of 'fabric first' homes in Norwich – with the aim being that the majority will be passive houses – through the city council's Fabric First Framework over the coming four years, there is a real and immediate need for multiple contractors to be upskilled to enable delivery of these homes.

Norfolk is not alone in embracing the benefits of the passive house standard; Exeter City Council and several Dublin local authorities are also advocates.

Encouragingly, the number of qualified certified passive house designers in the UK is growing (around 500 now) but designers still outnumber the qualified and certified trades by 5:1 – not a good enough ratio when considering the numbers of tradespeople that will touch these sites. While there are already a comparatively high number of certified passive house tradespeople in the Eastern region (25) this training can be expensive and can therefore exclude many would-be contractors from accessing the skills and knowledge.

In response to this, through a match-funded grant from the New Anglia Skills Deal Programme, provided by Norfolk County Council, Suffolk local authorities and the Skills Funding Agency, the planned £200k Fabric First Institute project has been developed. It aims to act as a catalyst for a step-change in construction practices both regionally and throughout the UK. Working collaboratively with regional partners from the construction, manufacturing and low energy sectors, educational establishments and local authorities, it aims to impact current construction practices to bring about change. It will up-skill both the workforce and students through development and delivery of a training programme and module, which will have a direct impact on the current building performance gap existing in the UK today.

Why is training needed?

It should be pointed out that none of this training is rocket science – simply best or rather good practice for the delivery of quality, high comfort homes and buildings whether or not they aim to meet the passive house standard.

The wider context of why training is needed is of course that successful delivery of this particular region's fabric-first ambitions will, it is hoped, lead to further similar developments.

Using a more focused lens however, the training will be designed to tackle challenges faced by regional contractors both when delivering the passive house ►

standard on-site, and when trying to win this type of business.

The pricing game

With the above in mind from the very outset, a little like embarking on an obstacle course, contractors all leave the start line together. The first hurdle they face will be pricing. Finding subcontractors to price fairly (or at all) for passive house developments of all sizes can be tricky. Bad experiences, word of mouth horror stories and lack of understanding often lead to skewed pricing through assumed increased time for the job. While this is not an unreasonable assumption, this can be largely countered through accurately planning sequencing in, rather than leaving contingency time for troubleshooting and schedule over-runs.

Emma Osmundsen, housing development manager & client lead (Build), Exeter City Council:

"For contractors there are growing business opportunities within the passive house market. In order to capitalise on these opportunities contractors and their sub-contractor supply chain need to be suitably equipped and informed on what a passive house project entails. Whilst there is a growing knowledge and learning within the consultancy sector, the challenge is now to transfer that knowledge, experience and learning to the supply chain. For contractors to secure the 'leading edge' understanding a fabric-first approach to construction is critical. Understanding the risks, the sequencing and the level of site supervision need not result in excessive tender costs and passive house projects when de-mystified can be successfully delivered on site. Indeed, in Exeter we now experience contractors eager to work on more passive house projects, as they come to appreciate the simplicity and high level of outcomes the projects deliver. Being able to deliver to exacting standards with exemplar energy efficient results gives contractors a commercial advantage whether they are working on passive house or other low-energy building standards."

Quality Street

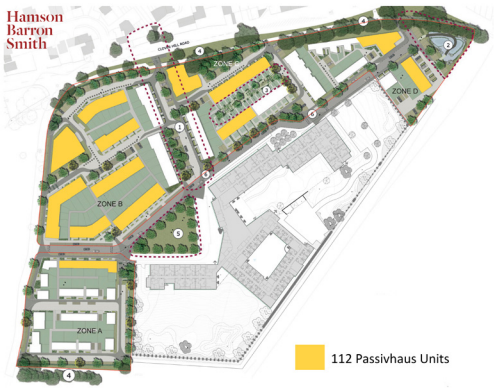
Once the contractors have won the work, the next challenge will be monitoring quality of workmanship on site. This can be particularly difficult on larger schemes but a great deal of risk can be eliminated with a well-informed (trained) workforce. The individuals become 'mini' inspectors and help identify problems before they are replicated, thus minimising disruption to works and any associated costs of remediation. Much time (cost) is lost by contractors and subcontractors through rectifying faults and poor performance as a result of not doing things right the first time.

The airtightness challenge

An ongoing challenge and by far most daunting obstacle for all involved in passive house is the airtightness challenge. This can be a real stress for the contractor particularly if there is a financial penalty written into the contract; a penalty clause that can go down the subcontractor chain. It creates an atmosphere of finger pointing and a blame culture on site. Airtightness needs to be collectively and collaboratively approached, a proper challenge for the 'silo-mentality' construction industry.

On this subject there is a considerable amount of learning or 'unlearning' of bad practices to be done. Currently, on a standard build, taping just doesn't happen, yet all buildings should be constructed to a predetermined airtightness value. In reality much is left to chance, many tubes of mastic and the luck of the draw on the day of the air test.

This training will help eradicate or minimise the challenges or issues with airtight taping, by raising awareness not only of best practice but providing suggestions of common sense approaches.



(opposite) Pictured with construction students at the opening of The David Lawrence Centre for Construction Skills at Easton and Otley College, where the Fabric First Institute training is set to be delivered are (-l-r) New Anglia LEP chairman Mark Pendlington, David Lawrence and current principal David Henley; (above) the training will support the roll-out of passive house projects in the region, where significant projects include the Hamson Barrow Smith-designed 172 unit scheme - including 112 passive houses - at Three Score in Bowthorpe

(above) Hamson Barron Smith's 10 unit passive apartment scheme at Hansard Close, which is being built using Cygnum's timber frame system; (below) The David Lawrence Centre for Construction Skills

As we have seen in our certified passive house tradespersons training, technique is everything and can not only significantly reduce the time it takes but also the amount of materials used. It must also be clear which products should be used where and not which product is closest to hand. Materials are expensive and should be treated with care and not left to be damaged on site. All this leads to the existence of newly created airtightness champions who are essential but further must have authority to question materials/workmanship on site.

Take a breather

Once good practice in terms of fabric is covered, the course will tackle the main ventilation issues that MVHR installation brings (design, installation, commissioning).

Currently there is a gap with most manufacturers between the design and installation on site. More often than not, no physical on-site assessment is made by the MVHR designers prior to formal sign-off of design and procurement of the materials, and as such it is often only during installation that problems are identified. This can be problematic for site-workers delivering on time with a constrained design. Together with what denotes best practice, understanding what can and cannot be done in the aforementioned instance will be key.

Tangible benefits of knowledge

There will be multiple benefits of taking the training but the most significant and impactful for contractors or subcontractors will be through knowledge gained and myths busted, winning more business and delivering this more profitably.

Paul Hamilton, senior project manager, R G Carter Limited:

"Training key members of staff to passive house tradesperson certification was an important part of our strategy for reducing the passive house 'skills gap' and achieving membership of Norwich City Council's prestigious Fabric First Framework.

We quickly recognised that it was important to train everyone – designers, management, estimators, surveyors, site managers, trades and our supply chain.

We believe the Fabric First Institute can provide a practical entry-level course that is well-suited to the needs of our staff and supply-chain partners alike. In our experience this investment in training has helped to greatly bring down the cost of delivery. The knowledge and skills gained have helped our supply chain understand the risks and the opportunities associated with passive house construction resulting in tangible benefits and reduced costs for all parties."

If contractors and subcontractors are better informed, they are able to make commercial decisions with much more validation. This knowledge will lead to improved likelihood of winning business through demonstrating that they have made a commitment to embracing change, recognising the shortfalls of how we do things today, and to working collaboratively. This could in turn also attract a better quality client, one who is concerned about quality and doing a good job.

Ultimately however, what everyone seeks is increased margin and reduced remedial work costs. A trained workforce will achieve this through delivery of a better product first time.

What will the Fabric First Institute actually deliver?

This project has an innovative approach in that it is a direct attempt to tackle the 'silo mentality' – a recognised barrier to the energy performance gap – via training delivered to multiple trades simultaneously. The aim of this is that the development of a shared sense of ownership, coupled with clear and consistent communication from concept design through delivery and into occupation, will shake up current practices.

The Norwich City Council Fabric First Framework development plans mean that there is real opportunity for those trained to gain practical experience and thus embed and encourage learning and practices to wider teams and businesses.

Project partners have come together to enable the development of a life-sized and functioning 'Fabric First' demonstration model building, to be used by both those within workforces receiving training, as well as college students and learners.

Over the summer, generous donations of materials made by suppliers including (but not limited to) Kingspan TEK and Wienerberger (wall solutions), Zehnder (MVHR), Veka and Roto (windows/doors/rooflights), together

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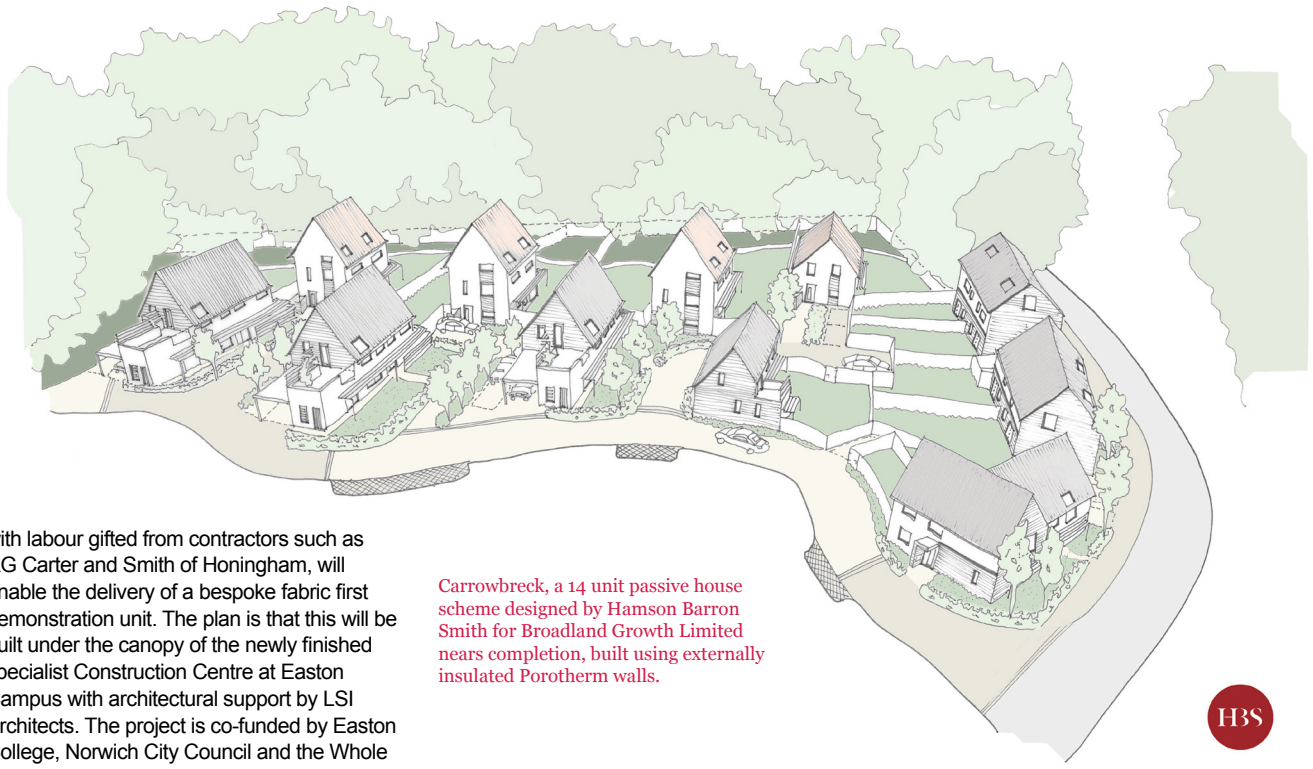


Carrowbreck, a 14 unit passive house scheme designed by Hamson Barron Smith for Broadland Growth Limited nears completion, built using externally insulated Porotherm walls.

with labour gifted from contractors such as RG Carter and Smith of Honingham, will enable the delivery of a bespoke fabric first demonstration unit. The plan is that this will be built under the canopy of the newly finished specialist Construction Centre at Easton Campus with architectural support by LSI Architects. The project is co-funded by Easton College, Norwich City Council and the Whole House Energy team.

The demonstration unit will cleverly incorporate a number of construction fabric types and window manufacturers, the point of course being that the industry can and do build out of any material — it's the energy standard that is being chased.

Based centrally within the county, the Easton College Construction Centre will become a centre of excellence to facilitate the training of contractors. It will do this whilst simultaneously educating those joining the sector through development of a new fabric first construction 'module' for students of all construction trades at the college.

Through the year-long project the Whole House Energy trainers will develop and deliver:

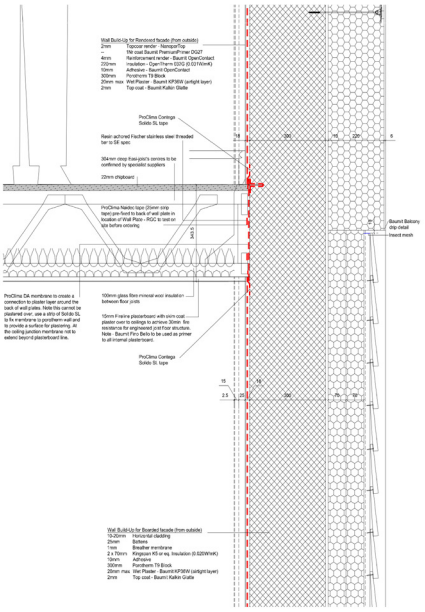
- An eight hour (one-day) training programme, focusing on core principles of fabric first/ passive house building methods. This will be a grant-funded programme, providing heavily subsidised training.
- A 30 hour module, focusing on core principles of fabric first/passive house building methods for students.

Both will consist of a combination of classroom-based and practical learning experiences, and will also act as an informal mentoring hub where students and contractors can share their new skills.

It is planned that doors will be open from October onwards for the delivery of twelve one-day training courses for up to 15 delegates each. Eight medium to large-scale contractors from inside and outside the region have pledged support and are already signed up. Importantly however, the course is open to all SME contractors and tradespeople in the region that would like to be upskilled.

The delivery of the module to Level 2/3 students at Easton College will precede the training for contractors. The new fabric first module, it is planned, will after a further period of development become accessible to other learning facilities in the UK after formal accreditation.

What is unique about this endeavor is that it demonstrates cross-sector recognition and action to rectify a skills gap at the sharp end of low energy building. It demonstrates an unusual level of collaboration which is hoped will be catalytic.



Intermediate Floor Detail - timber clad ground floor and rendered first floor
Scale 1:5

Interested?

For more details of the courses, availability and booking – and to see a full list of suppliers and project partners – visit the page on the Fabric First Institute on the Whole House Energy website at **www.wholehouseenergy.com/fabricfirstinstitute** or call Jackie at Whole House Energy.

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